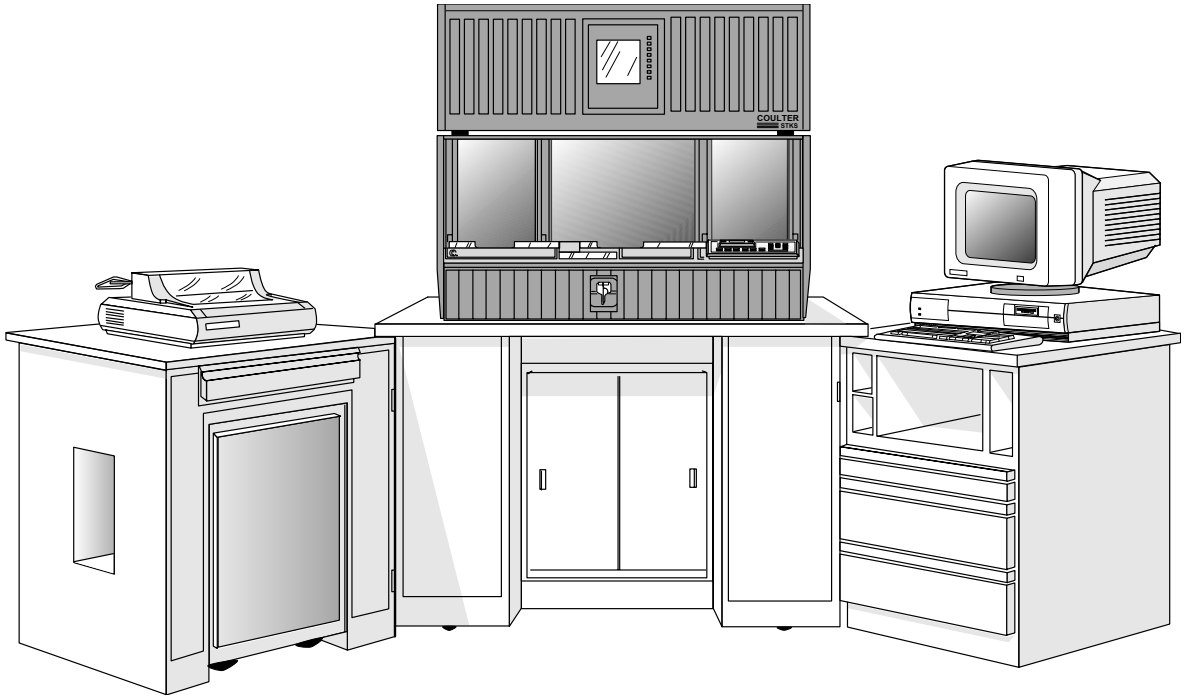
COULTER® STKS Analyzer with Reticulocyte Analysis

Special Procedures and Troubleshooting



PN 4237187B (March 1995)

COULTER CORPORATION
Miami, Florida 33196

READ ALL PRODUCT MANUALS AND CONSULT WITH COULTER-TRAINED PERSONNEL BEFORE ATTEMPTING TO OPERATE INSTRUMENT

HAZARDS AND OPERATIONAL PRECAUTIONS AND LIMITATIONS

WARNINGS, CAUTIONS, and IMPORTANTS alert you as follows:

WARNING - Might cause injury.
CAUTION - Might cause damage to the instrument.
IMPORTANT - Might cause misleading results.

CAUTION

System integrity might be compromised and operational errors might occur if:

- **This equipment is used in a manner other than specified. Operate the instrument as instructed in the Product Manuals.**
- **You introduced software that is not authorized by Coulter into your computer. Only operate your system's computer with software authorized by Coulter.**

Coulter Corporation urges its customers to comply with all national health and safety standards such as the use of barrier protection. This may include, but it is not limited to, protective eye wear, gloves, and suitable laboratory attire when operating or maintaining this or any other automated laboratory analyzer.

In the USA, for Service call Coulter Customer Operations 1-800-526-7694.

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1.1 LASER MAINTENANCE

WARNING

Do not try to remove the laser module from the Diluter.

All service and maintenance of the laser module must be done by trained Coulter personnel. Removal of the module must be performed only by a Coulter Representative.

1.2 GENERAL PROCEDURES

IMPORTANT

If a power failure or reset occurs during a cycle, after power up, press PRIME APERT before cycling samples.

This section details the cleaning, replacement, and adjustment procedures that are your responsibility. General operations that may apply to numerous procedures are described below. They include:

Power Down
Power Up
Optimize the Disk
Set Screen Saver
Position Rocker Bed
Diluter **F** Key Functions

Coulter recommends a Preventive Maintenance Inspection (PMI) once a year by a Coulter Service Representative.

Figure 1 illustrates component location on the Diluter front panel.

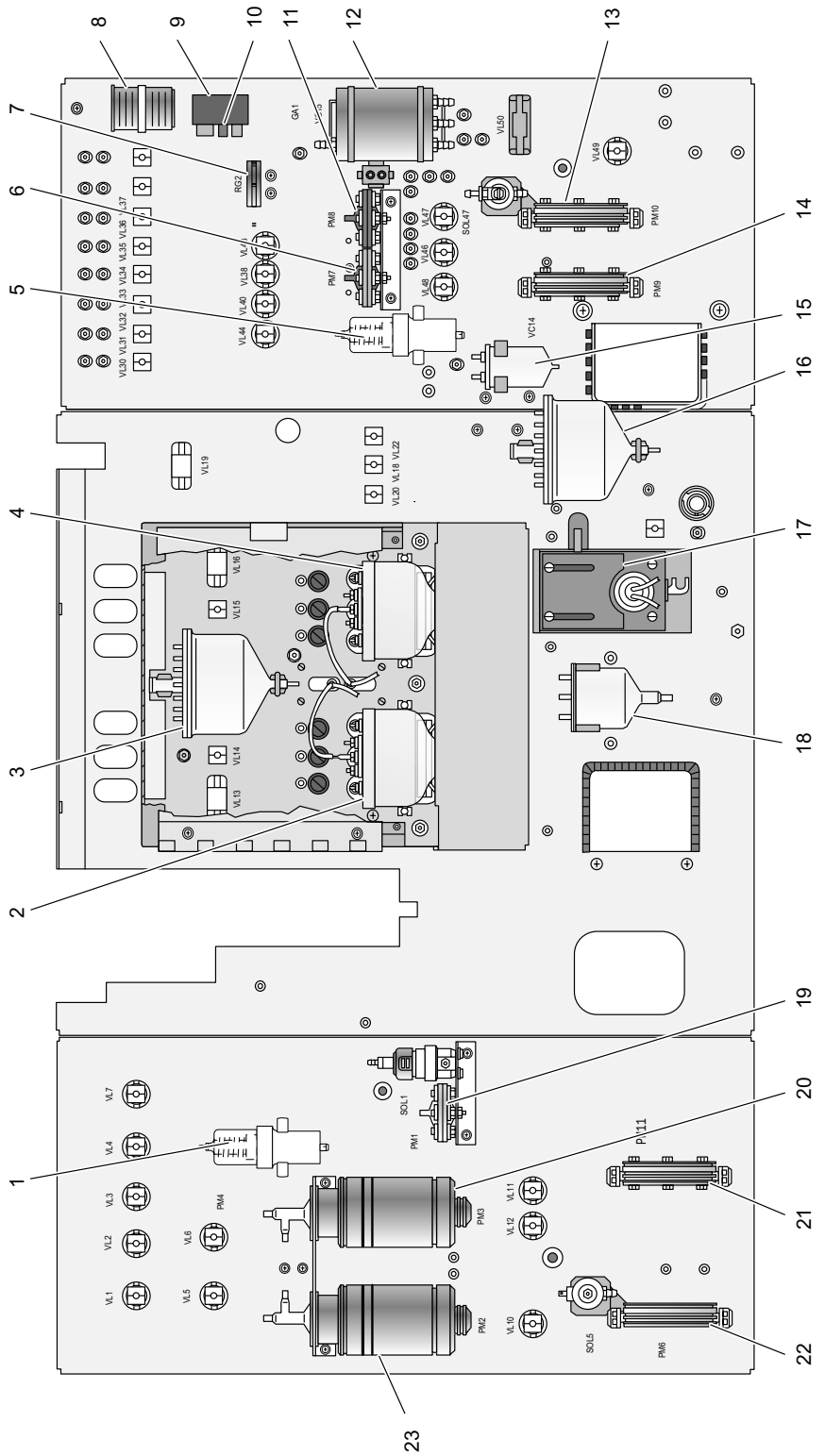

1. ERYTHROLYSE II PUMP (PM4)
2. RBC BATH (VC2)
3. VACUUM ISOLATOR (VC1)
4. WBC BATH (VC3)
5. STABILYSE PUMP (PM12)
6. CBC LYTIC REAGENT PUMP (PM7)
7. MANOMETER REGULATOR
8. SHEATH FLOW RESTRICTOR
9. ELECTRONIC MANOMETER WINDOW
10. MANOMETER RANGE SCALE
11. CBC LYTIC REAGENT PUMP (PM8)
12. SHEATH TANK (VC15)
13. 5mL CLEANING AGENT PUMP (PM10)
14. 5mL HGB PUMP (PM9)
15. FOAM TRAP (VC14)
16. WASTE CHAMBER (VC11)
17. HGB CUVETTE HOLDER
18. BATH OVERFLOW CHAMBER (VC10)
19. NEEDLE-RINSE PUMP (PM1)
20. WBC DILUENT DISPENSER (PM3)
21. RINSE MIX CHAMBER PUMP (PM11)
22. 1mL BACKWASH PUMP (PM6)
23. RBC DILUENT DISPENSER (PM2)
PM = PUMP
VC = VACUUM CHAMBER
7187002A

Figure 1 Diluter Front Panel

Power Down

1. Turn off the Graphic Printer.
2. Turn off the Ticket Printer.
3. Turn off the DMS.
4. Press **POWER OFF** on the Diluter keypad.
5. Turn off the MAIN POWER circuit breaker on the Power Supply.
6. Unplug the primary power cord from the wall outlet.
7. Verify that the power is disconnected:
   a. Turn on the MAIN POWER circuit breaker.
   b. Check the front panel of the Power Supply and be sure there are no lamps lighted. If any lamp lights, the power is still connected; you must repeat steps 5, 6 and 7.
8. Turn off the MAIN POWER circuit breaker.

Power Up

1. Plug the primary power cord into the wall outlet.
2. Turn on the MAIN POWER circuit breaker on the Power Supply.
3. Press **POWER ON** on the Diluter keypad.
4. Turn on the DMS.
5. Turn on the Ticket Printer.
6. Turn on the Graphic Printer.

Optimize the Disk

This system is equipped with the OPTune™ utility, a software utility that optimizes the hard drive on your DMS. Optimizing organizes files on your hard drive so that the DMS is faster and more efficient. The OPTune utility runs when you turn on the DMS and when you reset the DMS.

The OPTune utility performs three types of optimization: daily, weekly and monthly. The type it uses depends on how long it has been since the last optimization.

Daily

The fastest method, this type leaves each file

- 100% defragmented
- sorted in ascending order by name
- in contiguous order

Weekly

Takes about 50% longer than the daily method. Does everything the daily method does, plus it optimizes in the packed mode. It arranges the files on your hard drive so that they are end-to-end, with no space between them. Thus, new files are likely to be written to disk without being fragmented.

Monthly

The most thorough method. Does everything the weekly method does, plus it physically arranges files on the disk in the same order as the sorted directory entries. This method takes longer, but increases efficiency when accessing many files in sequential order.

The OPTune utility initially takes about 45 minutes to an hour to optimize a 240MB hard drive. After that, daily optimization takes about 30 to 40 seconds. The OPTune utility reorganizes only those files that need it; it does not reoptimize unnecessarily.

You can bypass the OPTune utility process by pressing Esc while the OPTune utility screen is in view. When the message *Do you want to stop? [Y/N]* appears, press Y. This message appears: *User terminated Verify*. The optimizing process stops and the system goes into the DMS program.

If there is a hard disk failure during the optimization process, for example lost clusters or cross-linked files, the OPTune utility prompts you to continue. Answer Yes to go on with the process. However, if this happens more than once a week, record the incident in your DMS maintenance log or your logbook and call Coulter Customer Operations.

If you always leave your system turned on, we recommend that you run the OPTune utility at least once a week, using one of these two options:

Option A

1. Turn off the Graphic Printer.
2. Turn off the DMS.
3. Wait at least 15 seconds.
4. Turn on the DMS.
5. Turn on the Graphic Printer.

Option B

Select

Special Functions
Sample Analysis Set up
Reset DMS

When you reset the DMS or turn it off then back on, these functions default to these conditions:

- Data Base storage: ON (DB↑)
- XB: ON (XB↑)
- AutoPrint: NONE (PR↓)
- AutoTransmit: OFF (HC↓)

Reset these options as needed according to your laboratory's protocol.

Set Screen Saver

The screen saver function makes the screen go blank when it is not being used. Figure 2 illustrates the Setup window. Select

Special Functions
Set Up
System Set Up
Screen Saver Time Out

Set the time, in minutes, for the length of time to elapse before the screen goes blank. You can enter from 0 to 99 minutes.

- A number from 1 to 99 means that, if there is no keystroke in that many minutes, the screen goes blank. The screen also goes blank when the compressor times out.

  The screen turns back on under these conditions:

  - The DMS receives a sample run.

  - You press a key on the DMS keyboard. The DMS executes the keystroke as it applied to the screen before it went blank.

- Zero means the screen saver will not be activated.

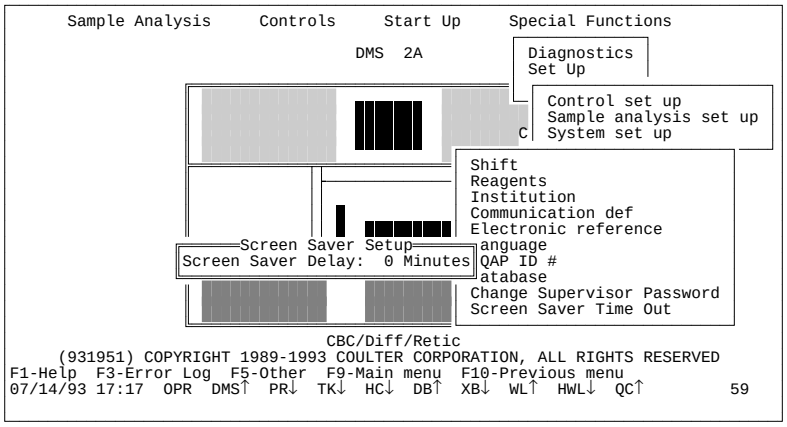


Figure 2 Screen Saver Setup

Position Rocker Bed

When the compressor is off, the rocker bed is not locked in position and can be tilted easily.

Diluter F Key Functions

The Diluter **F** key functions are listed in Table 1. To select these functions, press **F X X ENTER** where XX is the function number.

During these functions, a related message appears on the Diluter keypad; when the routine is finished, the message returns to the function number.

For example, when you select F01, the burn circuit activates and the message appears;

CLEAN APERTURES

after which the message returns to:

FUNCTION = 01

To repeat the function, press **ENTER**. To exit the function, press **STOP**.

Table 1 Diluter F Key Functions

Function	Message	Description
F01	*CLEAN APERTURES*	The burn circuit activates. This function applies current across the apertures to "burn" protein or debris off the apertures.
F02	*PRIME CBC LYSE*	The following sequence occurs twice: • Drains both baths then dispenses CBC lytic reagent into the WBC bath three times to prime the lyse line. • The WBC bath drains and the cycle repeats. • It then fills both baths with diluent and primes the apertures.
F03	*RBC AND WBC MIX*	Causes mixing bubbles to enter both the RBC and WBC baths.
F04	*DILUENT DISPENSE*	Dispenses 1 mL of diluent through the Secondary mode aspirator tip.
F05	*SOLENOID XX*	Use to manually activate individual solenoids (see Table 7). Enter the desired solenoid number (for numbers less than 10, enter a leading zero), and press **ENTER**.
F06	*RELEASE B.S.V.*	• Drains the baths • Bleeds off pressure • Rotates the BSV back and forth five times Use to check BSV function, free a stuck valve, or when cleaning the BSV to ease removal. Press **STOP** twice to exit the function. This function does not refill the baths; use **RINSE** to refill them with diluent.

continued

Table 1 Diluter F Key Functions

Function	Message	Description
continued		
F07	*BARCODE READ RATE TEST*	Checks the bar-code read rate on the cassette bar-code label, and on the four types of tube bar-code labels. 1. Enable the bar-code reader. 2. Remove the cap-piercing needle so that extensive piercings do not cause a plugged needle. 3. Place a cassette of bar-code labeled tubes on the rocker bed. 4. Select the function, then the following appears on the Diluter display: *A00B00C00D00E00* A represents Interleaved 2-of-5 B represents Code 39® Bar code C represents Codabar D represents the cassette label E represents code 128 The cassette automatically moves to the piercing station and the bar-code reader scans both the cassette and tube labels. On the display, the appropriate category increments by one each time a label from that category is read. Press **STOP** twice to exit the function.
F08	*PRIME SWEEP FLOW*	Primes the sweep-flow lines.
F09	*ZAP APERTURES*	• Applies pressure behind the baths • Drains and rinses the baths four times with cleaning agent • Draws the cleaning agent behind the apertures • Zaps the apertures 10 times After this function is complete, you must execute the startup cycle to purge the system of the cleaning agent.
F10	*RAISE NEEDLE*	Causes the piercing needle to rise and the rocker bed to lock in the backward position. Press **STOP** twice to exit.
F11	*EXTENDED PRIME*	Pulls fluid through the apertures to the vacuum isolator chamber for 60 seconds. Aperture current turns on and aperture lamp intensity increases for viewing the aperture screen.
F12	*EXTENDED CLEAR*	Clears the apertures for 60 seconds. Use to clear bleach.
F13	*PURGE MODE*	Use to clear air bubbles or debris from the flow cell.

continued

Table 1 Diluter F Key Functions

Function	Message	Description
continued		
F14	*PRIME PAK LYSE*	Used to prime the diff lyse lines for troubleshooting. For Service use only.
F15	*PRIME PAK PRESRV*	Used to prime the diff preservative reagent lines for troubleshooting. For Service use only.
F16	*PRIME DILUENT*	Use to prime diluent lines when you replace the diluent container.
F17	*PRIME SCATTER PAK*	Use to prime the diff reagents when you replace the SCATTER PAK.
F20	*FILL SHEATH TANK*	Used to fill the sheath tank as needed. For Service use only.
F44	*CLEAR FLOW CELL 1*	What it does to flow cell • purges it with cleaning agent • turns on its aperture current • applies low pressure to it • alternately applies vacuum to the bottom • checks it for a clog • leaves it in diluent See the Clear Flow Cell procedure for instructions on the use of this function.
F45	*CLEAR FLOW CELL 2*	What it does to flow cell • purges it with cleaning agent • turns on its aperture current • applies 30 psi to top of it • alternately applies vacuum to the bottom • checks it for a clog • leaves it in diluent See the Clear Flow Cell procedure for instructions on the use of this function.
F46	*CLEAR FLOW CELL 3*	Use **only** if F44 and F45 fail to clear flow cell. What it does to flow cell • purges it with cleaning agent • turns on its aperture current • applies low pressure to it • alternately applies vacuum to the bottom • leaves it in cleaning agent See the Clear Flow Cell procedure for instructions on the use of this function.
		continued

Table 1 Diluter F Key Functions

Function	Message	Description
continued		
F55 F56 F57	*LATRON CONTROL* *F55 = DIFF* *F56 = RETIC* *F57 = DIFF + RETIC*	Access this function before you aspirate LATRON primer and control. **CAUTION** **Do not use this function to aspirate anything except LATRON control or LATRON primer. Other material can cause damage to the system.** This function causes approximately 1.5 mL of primer or control to be aspirated through the Secondary mode aspirate tip directly into the flow cell.
F95	*SOLENOIDS FREE*	Frees the pressure from all solenoids. Press **STOP** twice to exit.
F96	*TUBE ADVANCE*	Use when you adjust the tube detector; causes a cassette to move through the piercing station one tube position at a time. Press **STOP** to halt the advance and make adjustments, **ENTER** to continue the advance and check alignment. Press **STOP** twice to exit the function.

1.3 COMPONENTS

This section includes

List of Cylinders
List of Manifolds
List of Pumps
List of Vacuum Chambers
Pinch Valve Functions
Solenoid Functions
Summary of Pinch Valve/Solenoid/Component Relationships

Cylinders (CL)

Table 2 lists the cylinders and the components they operate.

Table 2 Cylinders

Cylinder	Operates
CL1	BSV front
CL2	BSV back
CL3	needle
CL4	left lift
CL5	right lift
CL6	tube ram
CL7	bar-code reader
CL8	bed rocker
CL9	belt advance
CL10	stripper plate

Manifolds (MF)

Table 3 lists the Manifolds and their output.

Table 3 Manifolds

Manifold	Output
MF1	5 psi, level sense switches
MF2	pneumatic/hydraulic source input to Diluter, waste
MF3	30 psi
MF4	vacuum
MF6	30 psi, solenoid (SL) manifold
MF7	5 psi
MF8	5 psi, mixing bubbles
MF9	30 psi
MF10	vacuum
MF11	30 psi, SL manifold
MF12	vacuum
MF13	30 psi, SL manifold
MF15	30 psi

Pumps (PM)

Table 4 lists the pumps and what they operate.

Table 4 Pumps

Pump	Operates
PM1	needle rinse, 0.77 mL
PM2	RBC diluent dispense, 10 mL
PM3	WBC diluent dispense, 6 mL
PM4	5 diff lyse, 0.536 mL
PM6	backwash, 1 mL
PM7	3 diff lyse, 0.52 mL
PM8	3 diff lyse, 0.52 mL
PM9	Hgb blank, 5 mL
PM10	cleaning agent, 5 mL
PM11	rinse, 1 mL
PM12	leukocyte preservative, 0.193 mL
PM13	Primary mode aspiration, 0.250 mL
PM14	Secondary mode aspiration, 0.150 mL

Vacuum Chambers (VC)

Table 5 lists the vacuum chambers and the components they control.

Table 5 Vacuum Chambers

Vacuum Chamber	Controls
VC1	vacuum isolator (VIC)
VC2	RBC bath
VC3	WBC bath
VC4	RBC bath aperture 1
VC5	RBC bath aperture 2
VC6	RBC bath aperture 3
VC7	WBC bath aperture 1

continued

Table 5 Vacuum Chambers

Vacuum Chamber	Controls
continued	
VC8	WBC bath aperture 2
VC9	WBC bath aperture 3
VC10	bath overflow
VC11	waste chamber (Diluter)
VC13	waste chamber (Diff)
VC14	foam trap
VC15	sheath tank
VC16	sheath flow
VC17	vacuum tank
VC18	flow cell
VC19	mixing chamber
VC20	foam trap

Pinch Valve (VL) Functions

Table 6 lists the pinch valves sequentially, shows which solenoid (SL) controls the pinch valve, and gives each valve's function. See Figure 3 for most locations.

Legend: NC = Normally Closed
NO = Normally Open
NA = Normally Activated

Table 6 Pinch Valves

Pinch Valve	Solenoid	Pinch Valve Function
VL1	SL18	NC path from RBC diluent dispenser to BSV rear section, port 9 NO path from RBC diluent dispenser to BSV rear section, port 10
VL2	SL18	NC path from WBC diluent dispenser to BSV rear section, port 10 NO path from WBC diluent dispenser to BSV center section, port 8
VL3	SL9	NC 5 psi path to bath overflow chamber to drain it NO vent to bath overflow chamber

continued

Table 6 Pinch Valves

Pinch Valve	Solenoid	Pinch Valve Function
continued		
VL4	SL63	NC diff lyse pump dispense NO diff lyse pump fill
VL5	SL8	NC RBC diluent dispenser dispense NO RBC diluent dispenser fill
VL6	SL7	NC WBC diluent dispenser dispense NO WBC diluent dispenser fill
VL7	--	Not used
VL10	SL13	NC backwash pump dispense for Secondary mode NO • backwash pump dispense for Primary mode • backwash pump fill for both modes
VL11	SL42	NC mix chamber rinse pump dispense NO mix chamber rinse pump fill
VL12	SL42	NC pressure to rinse pump for mix chamber NC vacuum to rinse pump for mix chamber
VL13	SL11	NC RBC count NO not used
VL14	SL18	NC path for rinse trough drain to VIC, primary mode NO not used
VL15	SL12	NC pressure for WBC bath drain NO vent to bath overflow chamber
VL16	SL10	NC WBC count NO not used
VL18	SL6	NC pressure for Hgb cuvette drain NO vent for Hgb cuvette
VL19	SL16	NC • VIC drain • 5 psi to VIC • Primary and Secondary mode backwash drain to waste chamber NO • not used • vacuum to VIC • not used
VL20	SL57	NC Primary mode drain to diff waste chamber NO Secondary mode drain to diff waste chamber
VL22	SL12	NC vacuum to main waste chamber NO pressure to main waste chamber

continued

Table 6 Pinch Valves

Pinch Valve	Solenoid	Pinch Valve Function
continued		
VL23	SL12	NC RBC bath drain NO output to main waste chamber
VL24	SL12	NC WBC bath drain NO output to main waste chamber
VL26	SL50	NO rinse from PM1 into mix chamber when deactivated
VL28	SL28	NC Hgb cuvette drain to waste chamber NO vent
VL29	SL49	NC vent diff waste chamber NO not used
VL30	SL51	NC sample pressure to mix chamber NO vent for mix chamber
VL31	SL54	NC sheath flow from tank to bottom half of flow cell NO not used
VL32	SL54	NC sheath flow from tank to top half of flow cell NO not used
VL33	SL49	NC sample drain from flow cell NO not used
VL34	SL55	NC forward flush drain to waste NO not used
VL35	SL12	NO high vacuum to low vacuum regulator NC not used
VL36	SL61	NC diff rinse pump - cleaner NO diff rinse pump - diluent
VL37	SL46	NC path for flush upper section of flow cell NO not used
VL38	SL17	NC high vacuum to VIC NO low vacuum to VIC
VL40	SL57	NC vacuum for secondary backwash drain to diff waste chamber NO not used
VL43	SL2	NC dispense lyse to WBC bath NO lyse pumps fill
VL44	SL60	NC diff preservative pump dispense NO diff preservative pump fill
VL45	--	Not used

continued

Table 6 Pinch Valves

Pinch Valve	Solenoid	Pinch Valve Function
continued		
VL46	SL3	NC pressure to lyse pumps NO vacuum to lyse pumps and Hgb blank pump
VL47	SL61	NC cleaner pump dispense NO cleaner pump fill
VL48	SL2	NC Hgb blank pump dispense NO Hgb blank pump fill
VL49	SL48	NC vacuum supply to drain mix chamber to diff waste chamber NO drain path for diff waste chamber
VL50	SL56	NC • vacuum • sheath fill • not used NO • sheath flow • sheath pressure • flow cell rinse to bottom of flow cell
VL52	SL44	NO blood and diff lyse delivery to mix chamber, Secondary mode NC not used
VL53	SL45	NO diff preservative delivery path to mix chamber NC not used
VL54	SL65	NO blood and diff lyse delivery to mix chamber, Primary mode NC not used
VL55	SL52	NO sample flow from mix chamber to flow cell
VL56	SL50	NC vacuum on mix chamber NO pressure on mix chamber
VL57	SL48	NC drain path not used NO not used
VL58	SL46	NC flush flow cell lower section NO not used
VL59	SL41	NC reverse flush drain from flow cell to waste chamber NO not used
VL68 NA	SL24	NC Primary mode aspiration disabled NO from primary aspiration pump to main waste chamber
VL69	SL24	NC from secondary aspiration pump to main waste chamber NO Secondary mode aspiration enabled
VL73 NA	SL58	NC Secondary mode aspiration and backwash disabled
VL74 NA	SL58	NC Primary mode aspiration and backwash disabled
VL76 NA	SL64	NC Primary mode aspiration disabled

continued

Table 6 Pinch Valves

Pinch Valve	Solenoid	Pinch Valve Function
continued		
VL77	SL62	NC Secondary mode backwash to waste chamber NO not used
VL78	SL58	NO diff lyse delivery enabled, Primary mode
VL79 NA	SL64	NC Secondary mode aspiration disabled
VL81	SL59	NO Primary mode backwash enabled
VL82	SL23	NO needle rinse backwash diluent
VL83	SL58	NO diff lyse delivery enabled, Secondary mode
VL84	--	Not used
VL85	SL59	NO Secondary mode backwash enabled
VL86	SL59	NC vacuum via vacuum tank to aspiration pumps NO pressure to aspiration pumps
VL87	SL13	NC Secondary mode rinse trough drain NO Primary mode rinse trough drain
VL88	SL62	NC Primary mode backwash to waste chamber NO not used

Solenoid (SL) Functions

Table 7 lists the solenoid functions and actions. See Figure 3 for most locations.

Table 7 Solenoids

Solenoid	Function	Action
	Diluter	
SL1	Rinse needle	PM1
SL2	Lyse/Hgb valve	VL43, VL48
SL3	Lyse/Hgb pump	VL46
SL4	Hgb drain valve	VL28
SL5	Backwash pump	PM6
SL6	Hgb/waste drain	VL18
SL7	WBC dispense	VL6, PM3
		continued

Table 7 Solenoids

Solenoid	Function	Action
continued		
SL8	RBC dispense	VL5, PM2
SL9	Whole blood aspiration/ Overflow bath drain	VL3, VL86
SL10	WBC count	VL16
SL11	RBC count	VL13
SL12	Bath drain (VL 14)	VL15, VL22, VL23, VL24, VL35
SL13	Manual backwash	VL10, VL87
SL14	Cleaner	VL27
SL15	Sample valve return	CL2
SL16	Vacuum isolator drain	VL19
SL17	Segment sample	VL38, VL68, VL69, CL2
SL18	WBC dispense to RBC bath	VL1, VL2, VL14
SL19	WBC sample mix	WBC bath
SL20	RBC sample mix	RBC bath
Transport System		
SL21	Right lift	CL5
SL22	Left lift	CL4
SL23	Needle up	VL82, CL3
SL24	Manual probe in	VL69, VL68, CL1
SL25	Ram tube	CL6
SL26	Bar-code reader	VL66, CL7
SL27	Backward bed rock	CL8
SL28	Bed lock	L1
SL29	Stripper plate	CL10
SL30	Forward bed rock	CL8
SL31	Flipper retract	L41, L42
SL32	Spare	
SL33	Needle vent pressure	QD1-11 to needle
SL34	Manual probe out - NO	CL1
SL35	Spare	

continued

Table 7 Solenoids

Solenoid	Function	Action
continued		
SL36	Belt advance	CL9
SL37	Needle down	CL3
SL38	Spare	
SL39	Spare	
SL40	Spare	
	Diff	
SL41	Rev flush	VL59
SL42	Rinse - diff	VL11, VL12
SL43	Lyse - diff	PM1
SL44	Lyse disable - diff, manual	VL52
SL45	Quench	VL53
SL46	Flush diff	VL37, VL58
SL47	Cleaner - diff	PM10
SL48	Drain - diff	VL57, VL49
SL49	Exit - diff	VL29, VL33
SL50	LATRON deliver	VL26, VL56
SL51	Sample pressure - diff	VL30
SL52	Sample disable - diff	VL55
SL53	Waste - diff	VC13
SL54	Sheath flow	VL31, VL32
SL55	Forward flush	VL34
SL56	Sheath refill	VL50
SL57	Probe/needle drain	VL20, VL40
SL58	Aspirate enable/ Lyse disable	VL78, VL83 (VL74, L73)
SL59	Backwash disable	VL81, VL85
SL60	Quench enable	VL44
SL61	Cleaner enable	VL36, VL47
SL62	Rinse metering tube	VL77, VL88
SL63	Lyse - diff enable	VL4
SL64	Segment diff - NO	VL76, VL79
SL65	Lyse disable - diff auto	VL54

continued

Table 7 Solenoids

Solenoid	Function	Action
continued		
SL81	Level sense	MF1

Figure 3 illustrates solenoid and pinch valve locations.

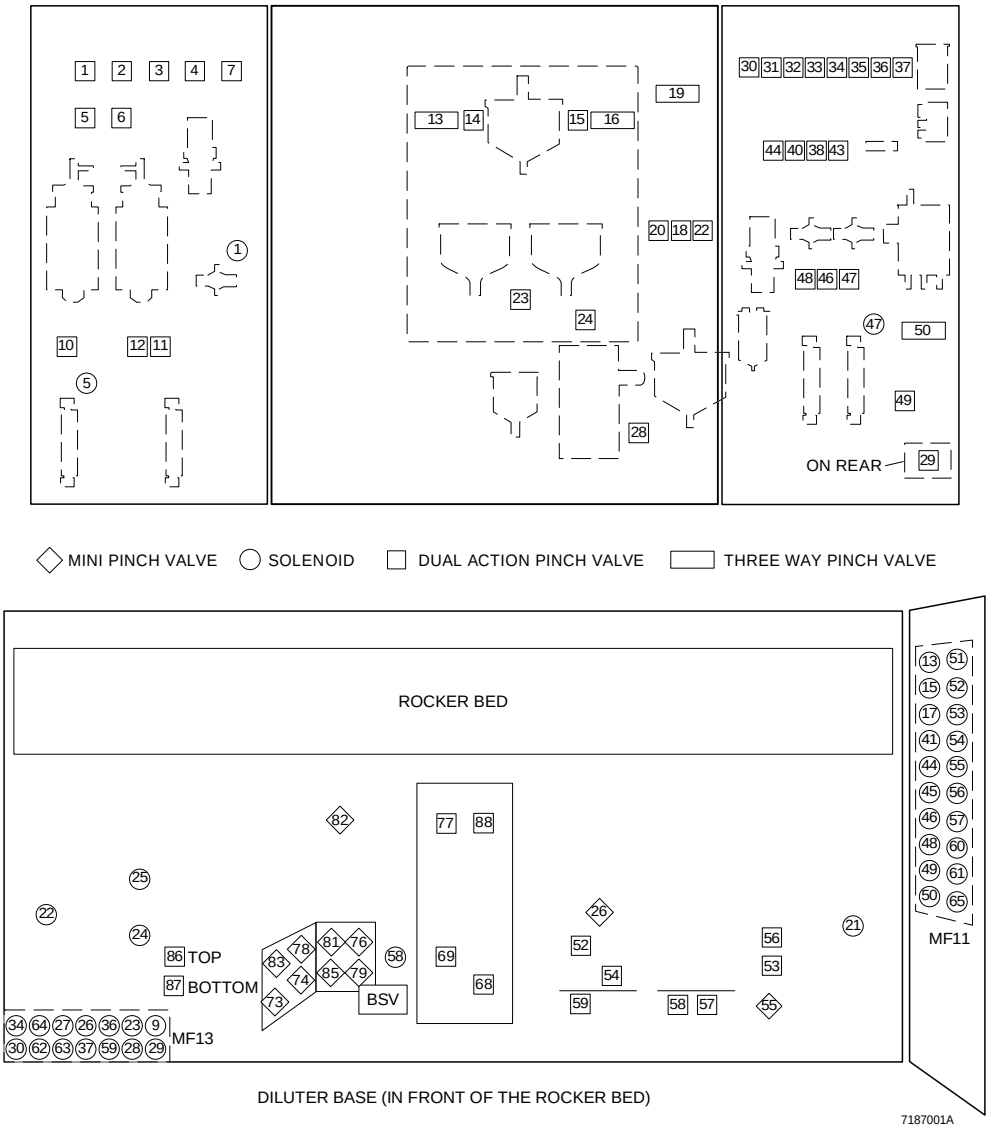


Figure 3 Pinch Valve and Solenoid Locations

2.1 GENERAL INFORMATION

For optimum performance of your COULTER® STKS with Reticulocyte Analysis, you must calibrate the CBC parameters. The WBC differential parameters are calibrated at the factory; they do not require calibration in the laboratory.

Your laboratory is responsible for the final calibration of the CBC parameters, for recording the calibration factors, and for establishing reference values for ramp-pulse and precision-pulse tests. Coulter recommends S-CAL® calibrator, or an exact equivalent, as an acceptable alternative to whole-blood calibration.

Calibrate the CBC parameters:

- At installation
- After the replacement of any component that involves the dilution characteristics (such as the BSV), or the primary measurements (such as the apertures)
- When advised to do so by your Coulter Service representative

Daily quality assurance programs monitor ongoing instrument and system performance. However, we recommend that you verify the status of instrument calibration quarterly, and/or when controls begin to show evidence of unusual trends, or when controls exceed the manufacturer's defined acceptable limits.

- Although the instrument is relatively insensitive to minor room temperature changes, perform calibration when the room temperature is stable and within the normal ambient temperature range. If the average ambient room temperature changes more than 10°F from the calibrating temperature, it is advisable to verify calibration and to recalibrate if necessary.
- In the normal process of tracking data for an extended period of time, your laboratory can make a specific decision to recalibrate a given parameter. Never adjust to a specific value for an individual sample.

- If a problem or malfunction occurs while performing these procedures, see the Troubleshooting procedures later in this manual. If the corrective procedures fail to eliminate the problem, call Coulter Customer Operations immediately.

2.2 PRECALIBRATION STEPS

Before calibrating, perform the following procedures in the order given.

1. Follow a, b or c as it applies to your instrument.

   a. If the instrument is in the shutdown condition, and you routinely shut down the instrument for a minimum of 30 minutes every 24 hours in COULTER CLENZ® cleaning agent, go to step 2.

   b. If you routinely use COULTER CLENZ cleaning agent, but you are beginning calibration after processing patient samples, shut down the instrument in the cleaning agent for 30 minutes to assure optimum aperture cleanliness before proceeding.

CAUTION

Do not aspirate bleach; bleach can damage the flow cell.

---

   c. If you do not routinely use COULTER CLENZ cleaning agent, perform the Bleach the Apertures procedure in Chapter 3.

2. Check the reagent containers for:

   a. Sufficient quantity

   b. Not beyond expiration date

   c. No precipitates, turbidity, particulate matter, or unusual color

   d. Proper connections between the Diluter and the reagent containers

WARNING

The contents of the waste container and its associated tubing can include residual biological material and must be handled with care. Avoid skin contact and clean up spills immediately. Dispose of the contents of the waste container in accordance with acceptable laboratory procedures.

3. Check the waste container for:

   a. Sufficient capacity

   b. Proper connections

4. Perform the startup procedures, including a quality-control check, as described in the Operator's Guide, PN 4237188. Verify that the following are acceptable: background count, reproducibility, carryover, and control recovery.

Reproducibility Check, CBC/Diff

Before you calibrate the STKS with either the S-CAL Kit or whole blood, perform a 10-sample reproducibility study on the CBC parameters in the Primary mode. You can also perform this study if you need to check instrument precision for the CBC or diff parameters.

In the Secondary mode, when you perform a Reproducibility check, do not cycle more than eight samples per tube. If you are running 31 samples, use four separate vials.

Sample Requirements

Collect enough blood for 10 cycles from a single donor who:

- Is receiving no medication.
- Has normal hematologic parameters, with a WBC count of 10,000 ±1,000.
- Has normal erythrocyte, leukocyte and platelet morphology and

- If you want to check the diff parameters, with diff values of

Neutrophils	40 to 72%
Lymphocytes	17 to 45%
Monocytes	4 to 12%
Eosinophils	0 to 10%
Basophils	0 to 1%

Procedure, Primary Mode

1. At the Diluter, press **PRIME APERT** to activate the pneumatics.

2. At the Analyzer:

   a. In SYSTEM CONFIGURATION, be sure that the BLOOD DETECTOR is set to ENABLED.

   b. In SYSTEM RUN, verify that the # aspirations/tube is 1.

3. At the DMS, select

   Special Functions
   Calibration
   Reproducibility

   If data remains from a previous study, press **F8** **Delete Table**.

4. Cycle one sample of normal whole blood in the Primary mode.

CAUTION

Do not pierce a specimen tube more than five times; additional piercing can obstruct or clog the needle.

---

5. At the Analyzer, set the number of aspirations per tube to 5.

6. Aliquot the well-mixed normal whole-blood sample into two red-topped tubes.

   a. Place the tubes into consecutive positions in a cassette, place the cassette in the loading bay, and press **START/CONT**.

   b. Monitor the system for normal sample flow.

7. Figure 4 illustrates the Reproducibility display. After the 11 cycles are complete, delete the first sample:

   a. Press the up arrow for the cursor to appear on Run 1.

   b. With the cursor on Run 1, press **F6** to delete the sample.

REPRODUCIBILITY

Cycle - CBC/diff N= 10 Mode=P

Run	WBC	RBC	HGB	MCV	RDW	PLT	MPV	LY%	MO%	NE%	EO%	BA%
DEL	10.1	4.49	13.4	89.4	14.1	221	10.7	26.9	14.6	52.6	5.8	0.1
2	9.9	4.42	13.4	89.4	14.2	224	10.8	28.5	14.5	51.8	5.0	0.2
3	10.0	4.42	13.4	89.0	14.0	221	11.0	26.6	15.2	52.0	6.0	0.2
4	9.9	4.40	13.4	89.2	14.5	225	10.8	26.3	15.4	52.7	5.4	0.2
5	10.0	4.43	13.4	89.4	14.1	221	10.8	27.3	14.7	52.1	5.7	0.2
6	10.1	4.40	13.5	89.3	14.0	228	10.8	26.0	15.8	52.3	5.7	0.2
7	9.9	4.38	13.5	88.8	14.2	209	10.8	27.7	15.5	50.9	5.7	0.2
8	9.9	4.42	13.4	89.3	14.1	214	10.8	27.9	14.4	52.1	5.4	0.2
9	10.1	4.44	13.5	88.8	14.1	224	10.8	28.4	15.2	51.0	5.2	0.2
10	10.1	4.41	13.5	89.3	14.2	225	10.8	27.3	15.1	52.0	5.4	0.2
11	9.9	4.44	13.4	88.8	14.0	215	10.7	28.1	14.8	51.7	5.1	0.3
Mean	10.0	4.42	13.4	89.1	14.1	220.6	10.8	27.4	15.1	51.9	5.5	0.2
2SD	0.18	0.04	0.10	0.51	0.30	12.0	0.15	1.75	0.91	1.10	0.63	0.06
%CV	0.9	0.5	0.4	0.3	1.1	2.7	0.7	3.2	3.0	1.1	5.7	15.0
Min	9.9	4.38	13.4	88.8	14.0	209.0	10.7	26.0	14.4	50.9	5.0	0.2
Max	10.1	4.44	13.5	89.4	14.5	228.0	11.0	28.5	15.8	52.7	6.0	0.3
Diff	0.2	0.06	0.1	0.6	0.5	19.0	0.3	2.5	1.4	1.8	1.0	0.1

F1-Help F4-Print F6-Remove/Restore F8-Del Table F9-Menu

10/30/93 10 00 OPR DMS↑ PR↓ TK↓ HC↑ DB↑ XB↑ WL↓ HWL↓ QC↑ 56 1

Figure 4 Reproducibility

8. Check results. Verify that the %CV (Coefficient of Variation) does not exceed these limits:

Parameter	%CV
WBC	2.5%
RBC	0.8%
Hgb	0.8%
MCV	0.8%
Plt	3.2%
MPV	5.0%

If you are checking diff parameters, check the low-to-high difference with the limits below.

Diff Parameters	Max Range/Low to High (check DIFF line at bottom of screen)
LY%	≤ 2.7
MO%	≤ 2.7
NE%	≤ 3.0
EO%	≤ 1.4
BA%	≤ 1.3

If any instrument results exceed these %CV limits, or low-to-high Max range limits, there could be an instrument problem. Call Coulter Customer Operations.

Carryover Check

The Carryover check is designed to check carryover of blood from a high-to-low sample. In this check, carryover from a blood sample to diluent is checked.

Perform the Carryover study before you calibrate with the S-CAL Kit or whole blood. You can also perform the study if you suspect a carryover problem on your instrument.

Sample Requirements

Choose a sample with a WBC count of 10,000 ±1,000.

The parameters checked are WBC, RBC, Hgb and Plt. The system must be in the CBC mode of operation.

Procedure

1. Press **PRIME APERT** to activate the pneumatics.

2. At the Analyzer:

   a. In SYSTEM CONFIGURATION, set BLOOD DETECTOR to DISABLED. Set MODE OF OPERATION to CBC.

   b. In SYSTEM RUN, set # aspirations/tube to 1.

3. If it is necessary to run a PRIME sample, select

   Sample Analysis
   Run Samples

   Refer to the Operator's Guide, PN 4237188, for when to prime.

   a. Press F5 **Other** then F7 **Prime** to turn Prime ON.

   b. Press Esc to return to Run Samples screen.

   c. Place a tube of normal whole blood into a cassette. Place the cassette in the loading bay and press **START/CONT**.

   d. Monitor the system for normal sample flow.

   e. After the DMS receives the Prime results, the system returns to READY. Turn Prime OFF using F5 **Other** then F7 **Prime**, and go on to step 4.

4. At the DMS, go to the Carryover screen. Select

   Special Functions
   Calibration
   Carryover

5. Aliquot the well-mixed whole blood sample into two 5 mL red-topped tubes.

6. At the Diluter keypad, press **F 0 4**, press **ENTER** two or three times to dispense 2 to 3 mL of diluent into three separate 5 mL red-topped tubes. Press **STOP**, then the system returns to READY.

7. Place the two blood sample tubes followed by three diluent tubes in a cassette, and place the cassette in the loading bay.

8. Press **START/CONT**.

9. Percent carryover is calculated by the formula:

$$\frac{\text{1st diluent - 3d diluent}}{\text{2d sample}} \times 100 = \%\ \text{carryover}$$

   When the carryover study is completed and the results are within limits, the message *CARRYOVER ACCEPTABLE* appears in the lower right-hand corner of the screen; see Figure 5. Disregard any minus signs.

If negative carryover values persist, and the third diluent is higher than the first two, check background.

10. At the DMS press **F4 Print** to print results. When you exit the Carryover mode, all data is erased.

11. If Carryover is not acceptable, the message *REVIEW CARRYOVER* appears in the lower right-hand corner of the screen, and Carryover values are flagged with H. There could be an instrument problem; call Coulter Customer Operations.

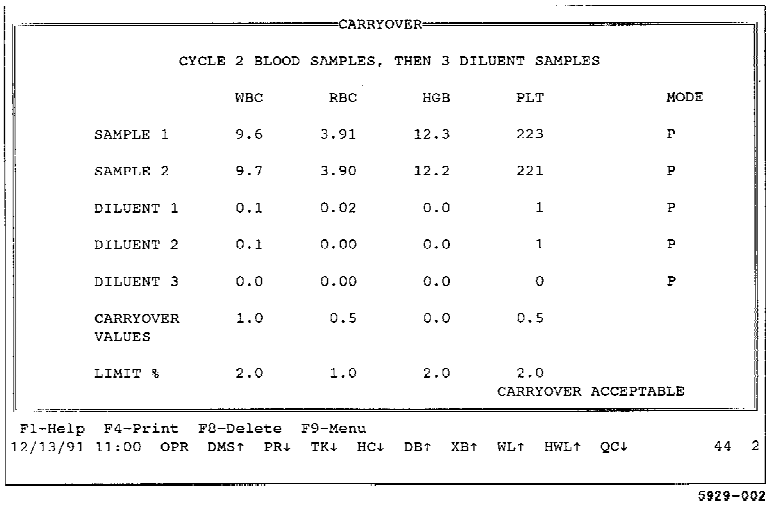

CARRYOVER
CYCLE 2 BLOOD SAMPLES, THEN 3 DILUENT SAMPLES
WBC RBC HGB PLT MODE
SAMPLE 1 9.6 3.91 12.3 223 P
SAMPLE 2 9.7 3.90 12.2 221 P
DILUENT 1 0.1 0.02 0.0 1 P
DILUENT 2 0.1 0.00 0.0 1 P
DILUENT 3 0.0 0.00 0.0 0 P
CARRYOVER VALUES 1.0 0.5 0.0 0.5
LIMIT % 2.0 1.0 2.0 2.0
CARRYOVER ACCEPTABLE
F1-Help F4-Print F8-Delete F9-Menu
12/13/91 11:00 OPR DMS↑ PR↓ TK↓ HC↓ DB↑ XB↑ WL↑ HWL↑ QC↓ 44 2
5929-002

Figure 5 Carryover Acceptable Screen

2.3 CBC CALIBRATION WITH S-CAL CALIBRATOR

Use the S-CAL calibrator, its package insert, and this procedure to calibrate the CBC parameters.

Calibration Summary

In the calibration procedure, you

- Send the existing calibration factors from the Analyzer to the DMS.
- Perform calibration. The DMS tabulates the results. Adjust the calibration factors as needed.
- Send the new calibration factors back to the Analyzer.

- Verify calibration.

CAUTION

On the Analyzer CRT, MODE OF OPERATION must be set to CBC when you cycle S-CAL calibrator.

---

1. At the Analyzer CRT, in SYSTEM RUN, press in sequence the keys next to:

   MAIN
   SYSTEM CONFIGURATION.

   - Set MODE OF OPERATION to CBC.
   - Verify that BLOOD DETECTOR is set to ENABLED.
   - Return to SYSTEM RUN.

2. At the Diluter press **PRIME APERT**.

3. At the DMS, turn Prime on. Select

   Sample Analysis
   Run Samples
   F5 Other
   F7 Prime

   Cycle a sample of normal whole blood in the Primary mode, then turn Prime off.

4. At the DMS, select

   Special Functions
   Calibration
   CBC Calibration

5. On the CBC Calibration screen, enter from the S-CAL calibrator package insert the

   - Reference values
   - Lot number
   - Expiration date

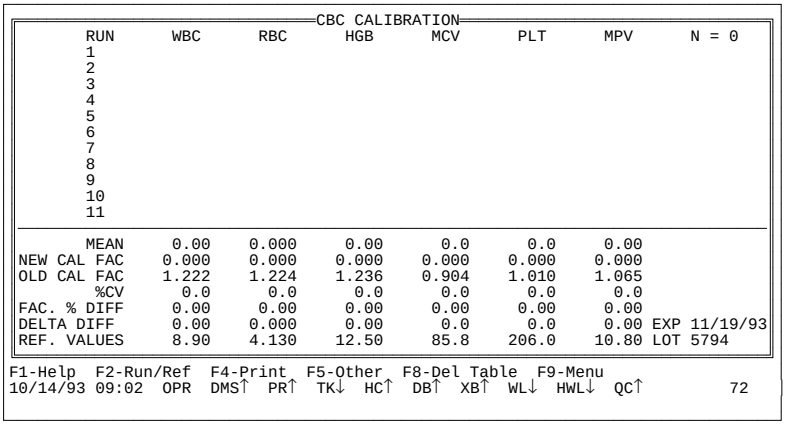


Figure 6 CBC Calibration Screen

6. At the Analyzer CRT:

   a. Transmit to the DMS the average calibration factors that are now in the Analyzer memory by pressing in sequence the key next to:

      MAIN
      ANALYZER FUNCTIONS
      CALIBRATION
      TRANSMIT AVERAGE CALIBRATION FACTORS

   b. Verify that the calibration factors have transmitted to the DMS. If all calibration factors are 1.000, at the Analyzer CRT,

      - Go to the CALIBRATION FACTORS screen.
      - Reenter the last valid set of calibration factors.
      - Perform step a again to retransmit.

   c. Return to the SYSTEM RUN display and set the number of aspirations per tube to 11.

IMPORTANT

Complete the calibration procedure within 1 hour of opening the vials.

---

7. Prepare the S-CAL calibrator according to the instructions on the package insert.

8. Place one of the vials of S-CAL calibrator in position 1 of a cassette, and place the cassette in the loading bay. Leave the other vial at room temperature for verification later.

9. At the Diluter keypad, press **START/CONT**. The system automatically pierces, aspirates, and analyzes the calibrator 11 times. The first sample is automatically deleted on the Calibration Run screen; it is a prime sample. Figure 6 illustrates this display.

10. Before using the newly calculated calibration factors, perform the following checks on the CBC Calibration table; see the calibration criteria flowchart in Figure 7.

    a. Inspect results for trending (a continual increase or decrease in values with replicate samples); the parameter results must not show a trend.

    b. On the display the Coefficient of Variation (%CV) has been calculated automatically. Check that the %CVs do not exceed the limits in Column A of the calibration criteria flowchart.

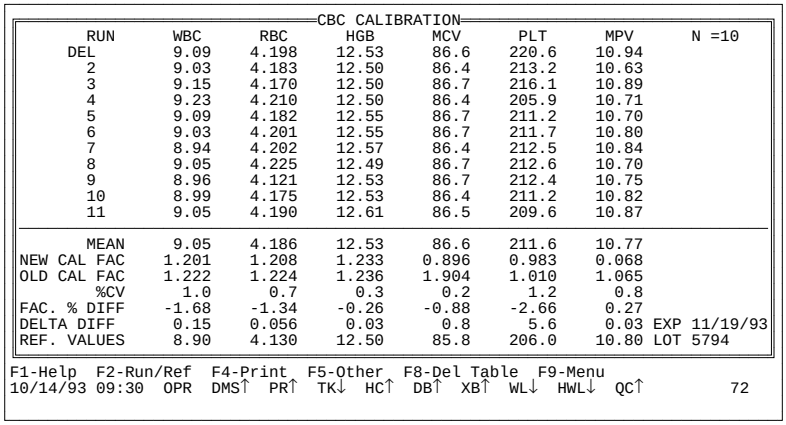
    c. Check that the FAC % DIFF numbers are less than or equal to the limits in Column B of the calibration criteria flowchart. Disregard negative (-) signs.

CAUTION

Do not calibrate MCV if RBC FAC % DIFF is out of range.

---

    d. If the results show trending, or if any parameter results exceed these %CV or difference limits, there could be an instrument problem; call Coulter Customer Operations. **Do not continue.**



CBC CALIBRATION

RUN	WBC	RBC	HGB	MCV	PLT	MPV	N =10
DEL	9.09	4.198	12.53	86.6	220.6	10.94	
2	9.03	4.183	12.50	86.4	213.2	10.63	
3	9.15	4.170	12.50	86.7	216.1	10.89	
4	9.23	4.210	12.50	86.4	205.9	10.71	
5	9.09	4.182	12.55	86.7	211.2	10.70	
6	9.03	4.201	12.55	86.7	211.7	10.80	
7	8.94	4.202	12.57	86.4	212.5	10.84	
8	9.05	4.225	12.49	86.7	212.6	10.70	
9	8.96	4.121	12.53	86.7	212.4	10.75	
10	8.99	4.175	12.53	86.4	211.2	10.82	
11	9.05	4.190	12.61	86.5	209.6	10.87	
MEAN	9.05	4.186	12.53	86.6	211.6	10.77	
NEW CAL FAC	1.201	1.208	1.233	0.896	0.983	0.068	
OLD CAL FAC	1.222	1.224	1.236	1.904	1.010	1.065	
%CV	1.0	0.7	0.3	0.2	1.2	0.8	
FAC. % DIFF	-1.68	-1.34	-0.26	-0.88	-2.66	0.27	
DELTA DIFF	0.15	0.056	0.03	0.8	5.6	0.03	EXP 11/19/93
REF. VALUES	8.90	4.130	12.50	85.8	206.0	10.80	LOT 5794

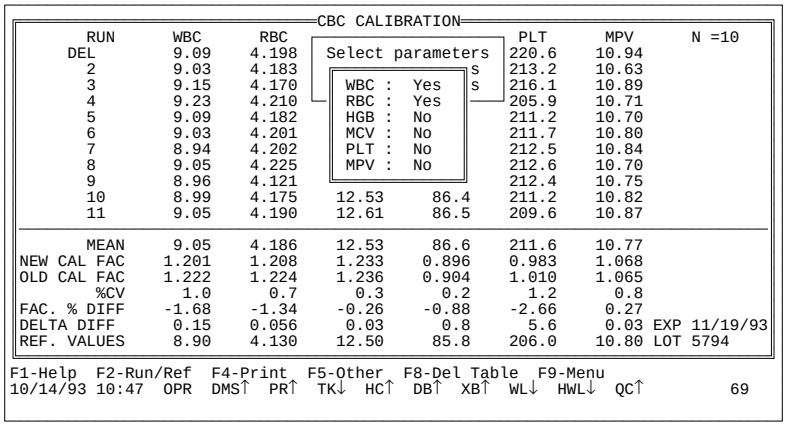
F1-Help F2-Run/Ref F4-Print F5-Other F8-Del Table F9-Menu
10/14/93 09:30 OPR DMS↑ PR↑ TK↓ HC↑ DB↑ XB↑ WL↓ HWL↓ QC↑ 72

11. On the CBC Calibration Table, check the FAC % DIFF and DELTA DIFF. Disregard negative (–) signs. If all the results are less than or equal to the following limits, your instrument's calibration is satisfactory; you do not need to go any further in this procedure. Press **F4 Print** to print the CBC Calibration Table.

	FAC % DIFF	DELTA DIFF
WBC	1.25%	0.1
RBC	0.70%	0.03
Hgb	0.78%	0.1
MCV	1.18%	1.0
Plt	2.70%	6.0
MPV	5.00%	0.5

12. If any number is within the limits in Column C or Column D of the calibration criteria flowchart, press **F4 Print** to print the display.

13. Press **F5 Other** and choose **Select Parameters** to select parameters that need adjustment.



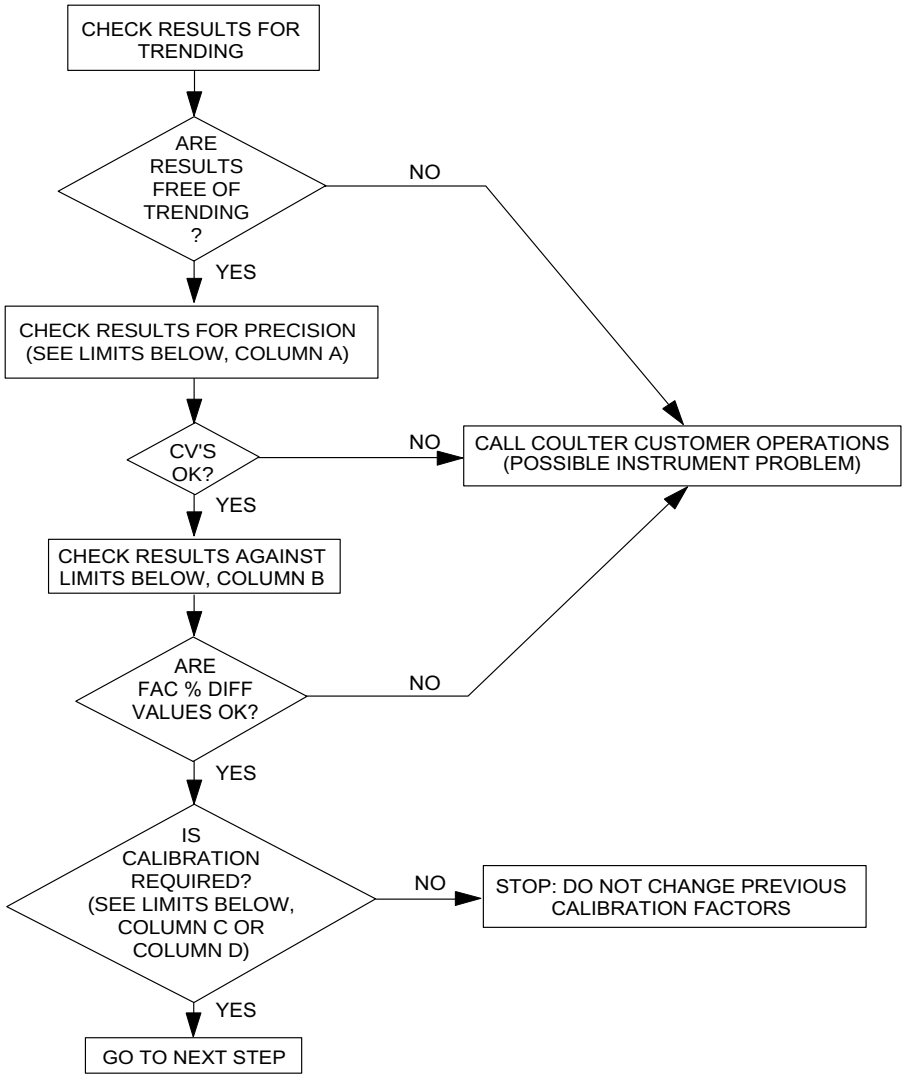
CBC CALIBRATION

Select parameters

WBC :	Yes
RBC :	Yes
HGB :	No
MCV :	No
PLT :	No
MPV :	No

RUN	WBC	RBC	HGB	MCV	PLT	MPV	N =10
DEL	9.09	4.198			220.6	10.94	
2	9.03	4.183			213.2	10.63	
3	9.15	4.170			216.1	10.89	
4	9.23	4.210			205.9	10.71	
5	9.09	4.182			211.2	10.70	
6	9.03	4.201			211.7	10.80	
7	8.94	4.202			212.5	10.84	
8	9.05	4.225			212.6	10.70	
9	8.96	4.121			212.4	10.75	
10	8.99	4.175	12.53	86.4	211.2	10.82	
11	9.05	4.190	12.61	86.5	209.6	10.87	
MEAN	9.05	4.186	12.53	86.6	211.6	10.77	
NEW CAL FAC	1.201	1.208	1.233	0.896	0.983	1.068	
OLD CAL FAC	1.222	1.224	1.236	0.904	1.010	1.065	
%CV	1.0	0.7	0.3	0.2	1.2	0.8	
FAC. % DIFF	-1.68	-1.34	-0.26	-0.88	-2.66	0.27	
DELTA DIFF	0.15	0.056	0.03	0.8	5.6	0.03	EXP 11/19/93
REF. VALUES	8.90	4.130	12.50	85.8	206.0	10.80	LOT 5794

F1-Help F2-Run/Ref F4-Print F5-Other F8-Del Table F9-Menu
10/14/93 10:47 OPR DMS↑ PR↑ TK↓ HC↑ DB↑ XB↑ WL↓ HWL↓ QC↑ 69



CALIBRATION CRITERIA

PARAMETER	(A) PRECISION (CV%)	(B) ACCEPTABLE FAC % DIFF	(C) CALIBRATE IF FAC % DIFF IS:	(D) CALIBRATE IF DELTA DIFF IS:
WBC	CV ≤ 2.5%	≤ 5.0%	>1.25% BUT ≤ 5.0%	>0.1 BUT ≤ 0.4
RBC	CV ≤ 0.8%	≤ 2.0%	>0.7% BUT ≤ 2.0%	>0.03 BUT ≤ 0.09
HGB	CV ≤ 0.8%	≤ 3.0%	>0.78% BUT ≤ 3.0%	>0.1 BUT ≤ 0.4
MCV	CV ≤ 0.8%	≤ 2.5%	>1.18% BUT ≤ 2.5%	>1.0 BUT ≤ 2.0
PLT	CV ≤ 3.2%	≤ 9.0%	>2.70% BUT ≤ 9.0%	>6.0 BUT ≤ 20.0
MPV	CV ≤ 5.0%	≤ 20.0%	>5.0% BUT ≤ 20.0%	>0.5 BUT ≤ 2.0

7187006A

Figure 7 Calibration Criteria Flowchart

14. Press the space bar to toggle between Yes and No; set parameters that need adjustment to Yes, and parameters that do not need adjustment to No. Press Esc twice to return to the Calibration screen.

15. Press F4 **Print** to print the display, or record the new calibration factors in your logbook. Transfer the new calibration factors to the Analyzer:

    a. At the Analyzer CRT, press in sequence the key next to:

       MAIN
       ANALYZER FUNCTIONS
       CALIBRATION
       RECEIVE AVERAGE CALIBRATION FACTORS.

    b. At the DMS, from the CBC Calibration screen, press F5 **Other**.

    c. Select TRANSMIT FACTORS: press either T or ↓ then press Enter. The calibration factors are transmitted to the Analyzer and are displayed on the Analyzer CRT. The same calibration factors are updated on the DMS CBC CALIBRATION screen as the OLD CAL FAC, which are then used in the verification procedure below.

16. Verify that the values now displayed on the Analyzer CRT match the old calibration factors displayed on the DMS.

17. Verify calibration:

    a. At the Analyzer CRT go to SYSTEM RUN.

    b. On the DMS, press Esc to exit the F5 **Other** option.

    c. Press F8 to delete the accumulated CBC Calibration table data.

    d. Gently mix the second unlabeled screw-top vial of calibrator 10 times, and put the vial into a cassette; place the cassette in the loading bay.

    e. At the Diluter keypad press **START/CONT**.

    f. Monitor the calibrator results as they appear on the DMS. The first sample is deleted automatically; this is a prime sample.

g. Verify that all other calibrator results are acceptable. If the results show trending, or if any parameter results exceed the CV or difference limits, there could be an instrument problem; call Coulter Customer Operations. **Do not continue.**

h. Verify that the FAC % DIFF and DELTA DIFF values are less than or equal to these limits:

	FAC % DIFF	DELTA DIFF
WBC	1.25%	0.1
RBC	0.70%	0.03
Hgb	0.78%	0.1
MCV	1.18%	1.0
Plt	2.70%	6.0
MPV	5.00%	0.5

If you fail to recover a value within the FAC % DIFF or DELTA DIFF limits, call Coulter Customer Operations.

i. At the Analyzer CRT, set the number of aspirations per tube back to 01.

j. At the DMS, select

CBC Calibration
F5 Other
Select Parameters

Set all parameters to Yes.

k. Press Esc to return to the F5 **Other** window.

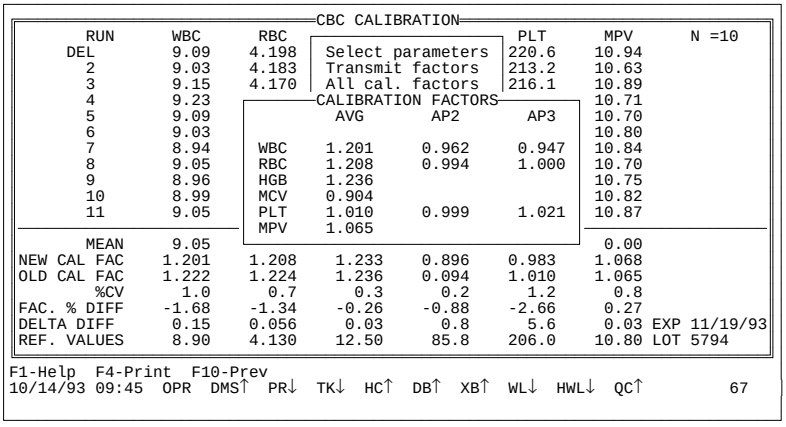
18. Display and record the average and single-aperture values as follows:

a. On the DMS, from the CBC Calibration F5 **Other** window, select

All Cal. Factors.

b. At the Analyzer CRT CALIBRATION menu, press the button next to TRANSMIT ALL CALIBRATION FACTORS.

c. Verify that the values on the DMS and the ANALYZER are identical.



d. At the DMS, press **F4 Print** to print the display for your records.

19. Establish new ramp and precision values for those parameters that were calibrated, and for any parameters that are calculated from them.

    a. At the Analyzer CRT, perform a set of three Ramp tests and a set of three Precision tests, and record the values. Do this three times a day for two days. Use the Startup display to receive the Ramp and Precision test values.

    b. Compute the average of the 18 values for each test. The average value is the new reference value.

    c. Enter the new reference values in the DMS. Select

    Special Functions
    Set Up
    System Set Up
    Electronic Reference

    Each time you perform the Startup cycles, the DMS compares the Ramp and Precision results to these values. If the results are not within ±1% of these reference values, they are flagged.

2.4 CALIBRATE CBC PARAMETERS WITH WHOLE BLOOD

An alternate method of calibrating the CBC parameters is by using whole blood. For whole-blood calibration, use a donor who:

- is not receiving medication
- has normal hematologic parameters
- has normal erythrocyte, leukocyte, and thrombocyte morphology

You must draw into and store specimens in the proper amount of K_3EDTA anticoagulant. If you use vacuum collection tubes, fill them to proper capacity.

To perform whole-blood calibration:

1. Obtain 20 normal, fresh whole-blood specimens. You need enough of each to cycle three samples on the STKS, and three samples on a reference instrument.

2. Transfer the calibration factors from the Analyzer to the DMS.

3. To prime, at the DMS select:

   Sample Analysis
   Run Samples
   F5 Other
   F7 Prime

   Cycle two samples of normal whole blood.

4. In the CBC Calibration mode, cycle each of the 20 samples three consecutive times in the Primary mode.

5. Obtain values from reference instruments; the following methods are suggested.

   - WBC and RBC: COULTER ZBI used with ISOTON® II diluent and ZAP-OGLOBIN® II lytic reagent; use large volume dilutions made with calibrated glassware.

   - Hgb: Hemiglobincyanide spectrophotometric procedure that follows NCCLS Standard H15-A. This method employs modified Drabkins (Ziljstra) Reagent and is referenced to NIST certified filters and ICSH standards.

- MCV: Packed-cell volume measured by a hematocrit procedure that follows NCCLS Standard H7-A. The PCV is not corrected for trapped plasma. MCV is calculated: PCV/RBC x 10.

- Plt: Phase contrast microscopy.

- MPV: Reference against latex particles.

6. Enter the reference values in the CBC CALIBRATION table on the DMS. The DMS then computes the new calibration factors.

7. Compare the reference values to the STKS values. Verify limits and transfer the new calibration factors to the Analyzer.

The cleaning procedures in this section are divided into four groups. They are presented in the order given below.

Blood Sampling Valve (BSV)
Apertures
Transport System
Other Components

3.1 CLEAN BLOOD SAMPLING VALVE (BSV)

Clean the BSV as needed:

- If there is excessive buildup of cleaning agent on the outside of the BSV, use Procedure A, Rinse the BSV Outside Surfaces.
- If you are instructed by Coulter Customer Operations to remove and clean the BSV sections, use Procedure B.

Procedure A, Rinse the BSV Outside Sections

WARNING

The BSV and its associated tubing can contain residual biological materials and must be handled with care. Avoid skin contact. Clean up spills immediately in accordance with acceptable laboratory procedures.

1. Open the Diluter lower front door.
2. Hold a container or several lint-free tissues beneath the BSV to catch the overflow, then rinse the outside surfaces with distilled water.
3. Dry the outside of the BSV with a lint-free tissue.
4. Close the Diluter door.
5. Resume normal operation.

Procedure B, Remove and Clean the BSV Sections

IMPORTANT

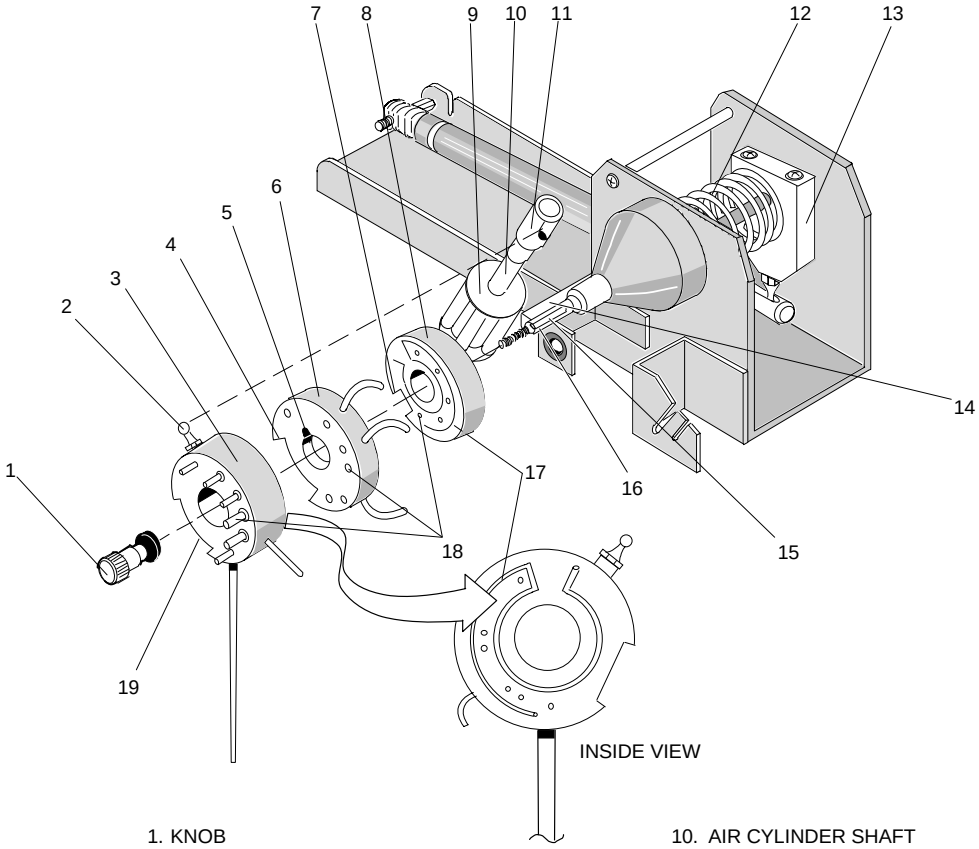
This is NOT a routine procedure and should only be done if instructed to do so by Coulter Customer Operations.

WARNING

The BSV and its associated tubing can contain residual biological materials and must be handled with care. Avoid skin contact. Clean up spills immediately in accordance with acceptable laboratory practices.

Use Figure 8 as a reference for component location.

1. At the Diluter, press **PRIME APERT** to activate the pneumatics.
2. At the Diluter keypad, press **DRAIN**. Wait 15 seconds, then press **F 0 6 ENTER**. The BSV rotates back and forth, and the pressure bleeds off.
3. When the BSV movement stops, open the Diluter lower front door.
4. For easier access, tilt the rocker bed into the backward position.
5. Locate the front section air cylinder.
6. Push back the sleeve on the air cylinder and rotate the sleeve so it does not slide back over the ball joint.
7. Lift the air cylinder shaft off the ball joint to disconnect the air cylinder from the front section.
8. Cover the area below the BSV assembly with several layers of lint-free tissue to catch overflow that occurs during the cleaning process.
9. Unscrew and remove the knob that holds the BSV in place.



1. KNOB
2. BALL JOINT
3. FRONT SECTION
4. NOTCH
5. KEY
6. CENTER SECTION
7. NOTCH
8. REAR SECTION
9. FRONT SECTION AIR CYLINDER
10. AIR CYLINDER SHAFT
11. AIR CYLINDER SLEEVE
12. SPRING
13. AIR CYLINDER DRIVER BLOCK
14. GUIDE POST
15. KEYWAY
16. MOUNTING POST
17. CLEANING CHANNELS
18. PASSAGEWAYS
19. NOTCH

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Figure 8 Blood Sampling Valve (BSV)

CAUTION

Do NOT try to remove the associated tubing from the BSV; to do so may cause damage to the fittings. Handle all sections carefully, and do not pull on the sample loop or any other metal fittings attached to the BSV.

10. Pull the three ceramic sections off the mounting post. To remove, manually move the air cylinder driver block as needed to position the BSV key and keyway.

11. Separate the three sections using a sliding, not pulling, motion. Lay the sections on the stack of lint-free tissue below the BSV assembly.

12. Clean the guide post and mounting post with distilled water and dry with a lint-free tissue.

CAUTION

Do not scratch or use abrasive materials on the inside surfaces. Never try to remove debris by inserting an object in the valve's passageways.

---

13. Hold a container or several lint-free tissues beneath the BSV to catch the overflow, then clean the passageways, inside surfaces, and center holes of the three sections, with a stream of cleaning agent from a wash bottle. Place the spout of the wash bottle over each opening and force the cleaning agent into the passageway to free and remove any debris or blood. If a stubborn plug remains lodged in the passageway, try a jet of filtered compressed air to dislodge. Use a lint-free tissue moistened with distilled water to remove any debris or dried blood that still remains on the surface.

14. Rinse the passageways and inside surfaces thoroughly with distilled water.

IMPORTANT

Before returning each section to the mounting post, moisten the inside surfaces with distilled water. Never use your fingers to spread water over the surfaces because there is oil on your skin.

---

15. Return the rear section to its original position; align the notch with the guide post and push the section into place.

16. Align the key of the center section with the keyway on the mounting post and push it into place. Manually move the air cylinder block as needed to position the key and keyway.

CAUTION

Before mounting the front section, make sure all tubing attached to the front section is positioned behind the aspirator tip.

17. Align the notch in the front section with the guide post and push the section into place.

18. Screw the knob onto the mounting post until compression of the spring is visible, then continue until fingertight.

19. At the air cylinder, while holding the air cylinder shaft securely, push back the sleeve and reattach the shaft to the ball joint on the front section of the BSV, then turn the sleeve to secure the ball joint.

20. Dry the outside of the BSV with a lint-free tissue.

21. Clean up the area beneath the BSV assembly.

22. At the Diluter keypad, press **STOP** twice to exit the F06 function, then press **RINSE** to refill the baths.

23. Cycle a sample of diluent in the Secondary mode and verify the BSV rotates properly and does not leak.

24. Close the Diluter door, disable the blood detector, and cycle a sample of diluent in the primary mode.

25. When the cycle is complete, open the Diluter lower front door and verify that the BSV is not leaking.

26. Close the Diluter door.

27. Before you run a control or patient sample, enable the blood detector and prime the system by pressing **PRIME APERT** on the Diluter and cycling

    - a normal whole-blood sample for **CBC** or **CBC+DIFF**, or
    - a prepared Retic sample for **RETICS**.

28. If the problem still exists, call Coulter Customer Operations.

3.2 CLEAN APERTURES

Clean the apertures as needed. Use these procedures:

Procedure A, Zap the Apertures
Procedure B, Bleach the Apertures
Procedure C, Clean the Aperture Baths
Procedure D, Clogged Aperture
Procedure E, Clear Flow Cell Clog

Procedure A, Zap the Apertures

Zap the apertures

- If you fail to recover control values or
- If you observe decreased cell counts, increased MCV values, or increased voteouts.

1. At the Diluter, press **PRIME APERT** to turn on pneumatics.
2. Perform function F09, ZAP APERTURES: press **F 0 9 ENTER**.
3. When the cycle is complete, press **STOP** to exit function F09, then press **START UP**.
4. After the startup cycle is complete, prime by running a normal whole blood sample.
5. Run controls in the CBC mode.
6. If the problem still exists, bleach the apertures as described in Procedure B.

Procedure B, Bleach the Apertures

Signs that the apertures require bleaching include:

- Increased voteouts
- Increased MCV values and decreased cell counts
- Failure to recover control values.

Systems using COULTER CLENZ cleaning agent for at least 30 minutes/ day do not need to bleach the apertures routinely. Before bleaching, check that the apertures are not clogged; if an aperture appears clogged, see Procedure D, Clogged Aperture. Use Figure 9 for reference.

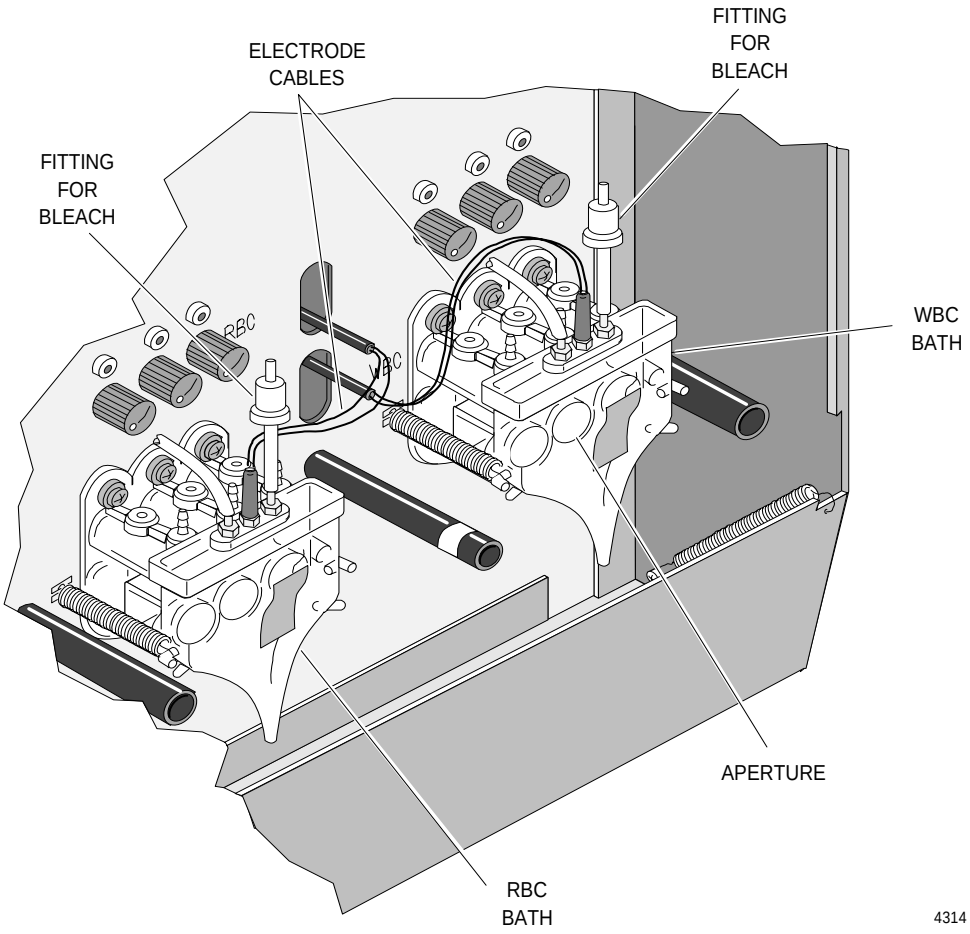


Figure 9 RBC and WBC Aperture Baths

CAUTION

Do not aspirate bleach; bleach can damage the flow cell.

CAUTION

ISOTON III diluent is not compatible with bleach. Do not mix them.

1. Put approximately 40 mL of a fresh solution of one part bleach and one part distilled water into a wash bottle; mix. Use a high quality, fragrance-free household bleach (5% solution of sodium hypochlorite).

2. Connect a 20-cm (7-in.) piece of tubing to the spout of the wash bottle containing the bleach solution.

3. Lift the Diluter center front door and slide it back into the cabinet.

4. Pull out the light bar.

5. Open the clear plastic door to the bath compartment.

6. On the Diluter keypad:

   a. Press **PRIME APERT** to turn on the pneumatics.

   b. Press **DRAIN** until the aperture baths drain completely into the waste chamber.

7. Locate the fitting for the bleach on the top right of each bath.

8. Connect the loose end of the tubing on the wash bottle to the fitting for bleach on the WBC bath.

9. Put the bleach solution into the WBC bath so that the solution is within 1/2 in. from the top of the bath.

10. On the Diluter keypad:

    a. Press **F 0 5 ENTER**.

    b. Press **1 2 ENTER** to drain the WBC bath into the Hgb cuvette.

    c. Press **STOP** three times to exit the function.

11. Refill the WBC bath with bleach solution.

12. Disconnect the tubing from the fitting on top of the WBC bath and connect it to the fitting on top of the RBC bath.

13. Put the bleach solution into the RBC bath so that the solution is within 1/2 in. from the top of the bath.

14. Disconnect the tubing from the RBC bath and reconnect it to the WBC bath.

15. On the Diluter keypad, access the EXTENDED PRIME function:

    a. Press **F 1 1 ENTER** to pull the bleach solution through the apertures for 60 seconds. If necessary, add more bleach solution to the WBC bath to keep the liquid level above the apertures.

    b. Press **STOP** to exit the function.

16. Disconnect the wash bottle.

17. Leave the bleach solution in the baths for 15 minutes. If the rinse trough needs cleaning, this is a good time to do it; see the Rinse Trough cleaning procedure.

18. At the Diluter keypad:

    a. Press **DRAIN**.

    b. Access the EXTENDED CLEAR function: press **F 1 2 ENTER** to remove the bleach from behind the apertures. This function lasts 60 seconds; when it is finished, press **STOP** to exit.

    c. Press **DRAIN**.

19. Fill a wash bottle with cleaning agent.

20. Connect a 20-cm (7-in.) piece of tubing to the spout of the wash bottle.

IMPORTANT

COULTER CLENZ cleaning agent does not change color on contact with bleach.

---

21. Fill each bath to the top with cleaning agent to remove the residual bleach.

22. Press **DRAIN** to drain the baths.

23. Refill the baths with cleaning agent then drain them.

CAUTION

Do not let the waste chamber get too full or it will overflow.

24. Drain the waste chamber as needed; on the Diluter keypad:
    a. Press **F 0 5 ENTER** to access the solenoid function.
    b. Press **1 5 ENTER** to activate solenoid 15.
    c. Press **STOP** three times to exit function F05.
25. Disconnect the wash bottle.
26. Verify that **DRAIN** and **RINSE** function properly.
27. Press **SHUT DOWN**.

CAUTION

Failure to allow pressure to bleed off before pressing START UP can damage the compressor.

28. After the shutdown cycle is complete, wait at least 30 seconds for pressure to bleed off, then:
    a. At the Diluter keypad, press **PRIME APERT**, then **START UP**.
    b. At the DMS, access Startup.
29. Replace the light bar and close the Diluter section doors.
30. After the startup sequence is complete, verify that background results are acceptable, then dispense diluent:
    a. Hold a vial under the aspirator tip.
    b. Press **F 0 4 ENTER** to dispense 1 mL of diluent.
    c. Press **ENTER** again to dispense a second aliquot of diluent.
    d. Discard this diluent.

e. Hold a clean vial under the aspirator tip; tilt the vial so that diluent flows down the wall of the vial, thus preventing excessive microbubbles.

f. Press **ENTER** two more times to dispense 2 mL of diluent into the clean vial.

g. Press **STOP** to exit function F04.

31. At the DMS, select

Sample Analysis
Run Samples

Press F5 **Other** then F7 **Prime** to turn Prime on. Press Esc to return to the Run Samples screen. Cycle diluent three times in the secondary CBC mode. This is to remove all traces of bleach. Verify that the results of the third diluent do not exceed the following background limits:

WBC	0.20
RBC	0.01
Hgb	0.15
Plt	3.00

32. Before you run a control or patient sample, enable the blood detector and prime the system by presssing **PRIME APERT** on the Diluter and cycling in the mode to be used

- a normal whole-blood sample for CBC or CBC+DIFF mode, or
- a prepared Retic sample for RETIC mode.

Procedure C, Clean the Aperture Baths

Signs that an aperture bath needs cleaning include:

- Salt deposits on or around a large O-ring
- Bubbles in the sweep-flow lines above, but not below, the aperture blocks. First check that the bubbles are not caused by a loose fitting, which can be tightened.

When you perform this procedure, replace the O-rings if you have spares available. Remove and clean the aperture bath; see Figure 10.

1. Lift the Diluter center front door and slide it back into the cabinet.
2. Press **PRIME APERT** to turn on the pneumatics.
3. Press **DRAIN** until the baths are empty.
4. Power down.
5. Pull out the light bar.
6. Move the rocker bed to the backward position.
7. Pull open the compartment door beneath the baths. Keep the door open by anchoring the spring to the bottom edge as illustrated in Figure 10.
8. Unhook the spring attached to each side of the bath. Disconnect the electrode cable, where it is attached to the panel.
9. Gently pull the bath away from the blocks.

CAUTION

Do not move the external electrode, or you may create a carryover problem.

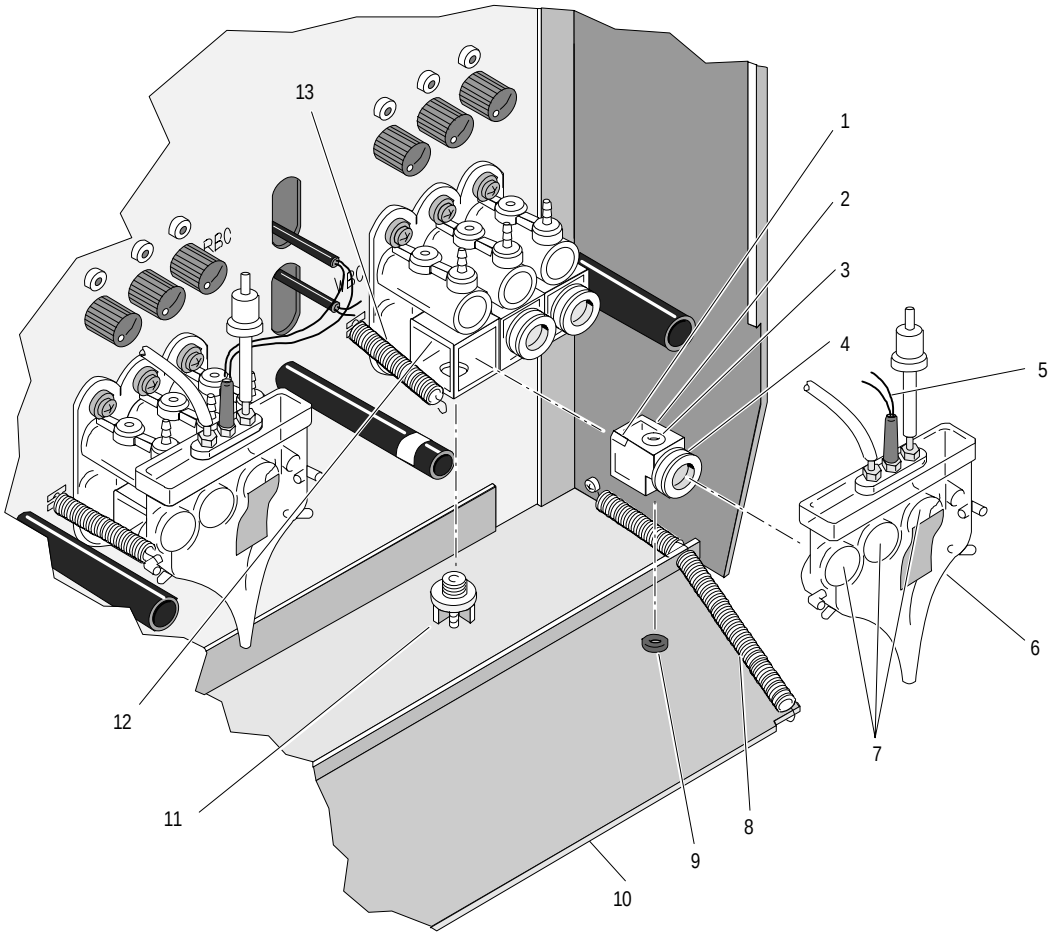
---

10. Moisten a lint-free tissue with distilled water, and clean the openings in the bath so that they are free of salt deposits.
11. If necessary, clean the area on and around the three large O-rings by wiping gently with a lint-free tissue moistened with distilled water. Visually inspect the large O-ring on each of the three blocks to check that they are free of salt deposits.
12. When ready to replace the bath, moisten the three large O-rings with distilled water.
13. Return the bath to its original position by gently rocking the bath onto the large O-rings until it snaps into place. The bath must be properly aligned with all three blocks to prevent leaking.
14. While holding the bath in place, hook the springs to each side of the bath.

15. Close the compartment door.

16. Power up.

17. Rinse and drain the baths several times and verify that there is no leakage.



LEGEND

1. BEVELED EDGE OF BLOCK
2. APERTURE BLOCK
3. SMALL O-RING
4. LARGE O-RING
5. ELECTRODE CABLE
6. APERTURE BATH
7. OPENINGS (3)
8. DOOR SPRING, ANCHORED
9. SMALL O-RING
10. COMPARTMENT DOOR PULLED DOWN
11. WHITE FITTING
12. APERTURE BLOCK HOUSING
13. BATH-HOLDER SPRING

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Figure 10 Aperture Bath, Blocks and Housings

18. Be sure the apertures are well covered with diluent, then:

    a. Press **F 0 5 ENTER**.

    b. Press **1 0 ENTER** to activate solenoid 10 for the WBC bath, or **1 1 ENTER** to activate solenoid 11 for the RBC bath.

    c. Verify that all three lines from the bath to the vacuum isolator are pulling a bubble-free stream.

    d. Press **STOP** three times to exit the function.

19. Replace the light bar; be careful not to pinch any tubing.

20. Close the Diluter center front door.

Procedure D, Clogged Apertures

If an aperture is clogged, try to dislodge the debris by pressing **CLEAR APERT** on the Diluter keypad. If the aperture is still clogged:

1. On the Diluter keypad:

    a. Press **PRIME APERT** to turn on the pneumatics.

    b. Press **F 0 1 ENTER** to activate the burn circuit.

    c. Press **ENTER** again.

    d. Exit the function by pressing **STOP**.

    e. Press **CLEAR APERT** again. If the aperture is still clogged, proceed to step 2.

2. Perform function F09, ZAP APERTURES: press **F 0 9 ENTER**. If this unclogs the aperture, press **START UP** to purge the system of the cleaning agent. If the aperture is still clogged, proceed to step 3.

3. Bleach the aperture as instructed in Procedure B. If the aperture is still clogged, proceed to step 4.

4. Remove the bath and clean the aperture with a camel-hair brush:

    a. Remove the bath as instructed in Procedure C.

b. Using the tip of the camel-hair brush supplied with your instrument, gently brush the aperture.

c. Return the bath to its original position, turn power on, rinse, and prime as instructed in Procedure C.

d. Turn power on.

e. Rinse and prime as instructed in Procedure C.

Procedure E, Clear Flow Cell

To manually unclog the flow cell aperture:

1. At the Diluter keypad, perform function F44, CLEAR FLOW CELL 1:

   press **F 4 4 ENTER**

2. If *Flow Cell Clogged* message appears on the Analyzer CRT, perform F45, CLEAR FLOW CELL 2 up to three times if necessary:

   press **F 4 5 ENTER**

3. If the flow cell is still clogged, use function 55, LATRON CONTROL, and aspirate LATRON primer up to three times.

CAUTION

F46 places greater stress on the flow cell than do the other functions. Use F46

- **only if the other procedures listed above fail to remove the clog, and**
- **never more than once unless specifically instructed to do so by Coulter Customer Operations.**

---

4. If the flow cell is still clogged, perform function F46, CLEAR FLOW CELL 3:

   press **F 4 6 ENTER**

   Let the instrument sit idle for 30 minutes.

5. Perform function 44 before analyzing samples.

6. If still clogged, call Coulter Customer Operations:

   1-800-526-7694.

3.3 TRANSPORT SYSTEM

The cleaning procedures related to the transport system are:

Rinse Trough
Cassettes
Stripper Plate
Rocker Bed Belt

Clean Rinse Trough

WARNING

The rinse trough may contain biohazardous material, and must be maintained with care. Avoid skin contact and dispose of cleaning materials properly.

Clean the Primary mode rinse trough as needed; see Figure 11. We recommend that you perform this procedure when you bleach the apertures. Symptoms that the rinse trough needs cleaning include:

- Rinse trough foaming
- Trough not draining
- Specimen on stripper plate.

WARNING

Use caution in the area of the piercing needle to avoid skin puncture.

---

1. At the Diluter, press **PRIME APERT** to turn on the pneumatics.

2. On the Diluter keypad, press **F 1 0 ENTER** to raise the needle.

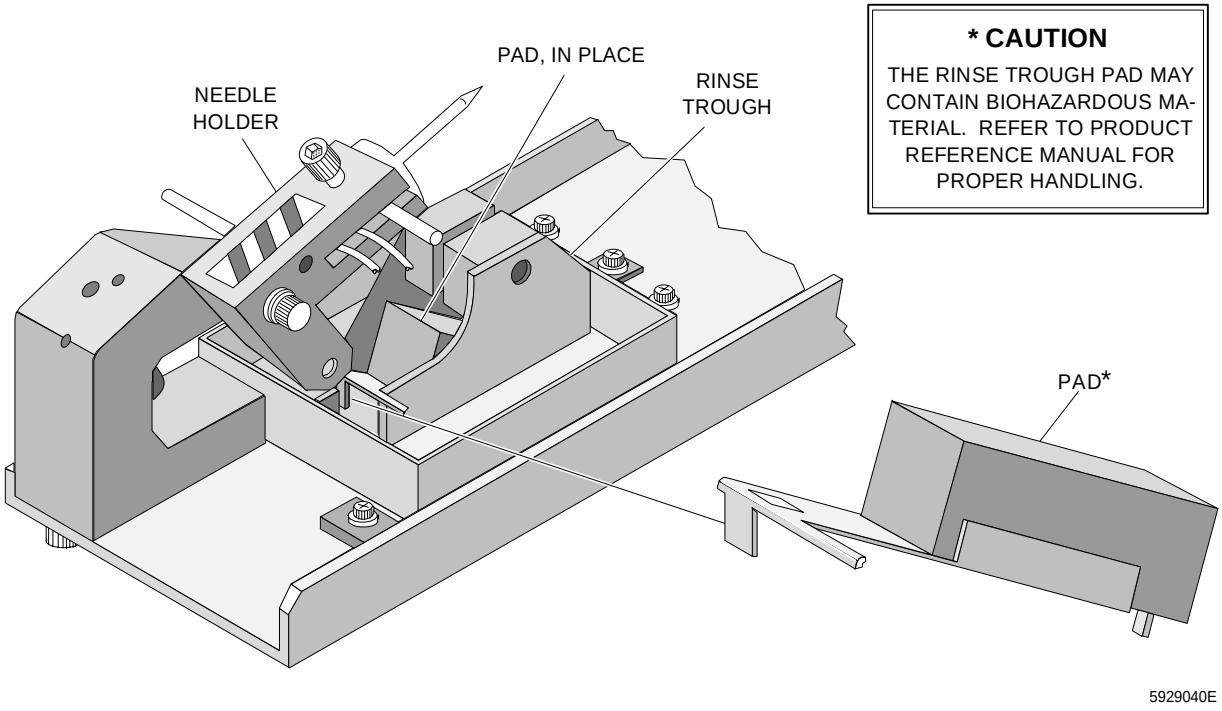

Figure 11 Rinse Trough

3. Open the door to the compartment that holds the needle.

4. Use a squeeze bottle to fill the trough with a 50% bleach solution (one part bleach to one part distilled water) until it covers the needle rinse pad.

5. Leave the bleach solution in the trough for 15 minutes.

6. Press **STOP** to exit F10. If the bleach solution overflows the trough, hold gauze pads with a hemostat and blot up the overflow.

7. Press **SHUT DOWN** to flush out the bleach solution.

8. Press **START UP**.

Clean Cassettes

Dirt, smears, pencil lead, or grease can affect bar-code label reading. Wash the cassettes as needed in warm soapy water and rinse thoroughly. Do not use an abrasive. Be careful not to scratch or otherwise harm the bar-code label.

Clean Stripper Plate

WARNING

There may be biohazardous material on the stripper plate. Take appropriate precautions. Follow your laboratory's protocol for safety measures.

Use cleaning agent on a gauze pad to wipe the plate; use a cotton swab around the opening.

Clean Rocker Bed Belt

To clean the conveyor belt on the rocker bed, wipe both sides with a cloth dampened with distilled water. Use only a damp cloth, not a wet one. Be careful not to get any components wet. Wipe the surfaces dry; lift the belt and thoroughly dry the underside of the belt and the rocker bed.

3.4 OTHER COMPONENTS

Cleaning procedures for other components are:

Air Filters
Vacuum Isolator Chamber (VIC)
Waste Chamber
Vacuum Trap Bottle
Overflow Chamber
Bleach RBC Internal Electrode
Drip Plate

Clean Air Filters

Clean the air filters in the Analyzer and Power Supply monthly; see Figure 12 for location. If, during the air filter cleaning procedure, you find a filter that is torn or shredded, discard the filter and replace with a new one.

1. Before removing any of the filters, power down.

2. The air filter in the Analyzer is on the lower edge of the back panel. Remove the cap from either end of the grille and pull out the filter.

3. The two air filters in the Power Supply are in the right side panel. It is not necessary to remove the panel; pinch and pull out the filters.

4. Wash the filters in soap and water, rinse them, dry completely, and replace.

5. Power up.

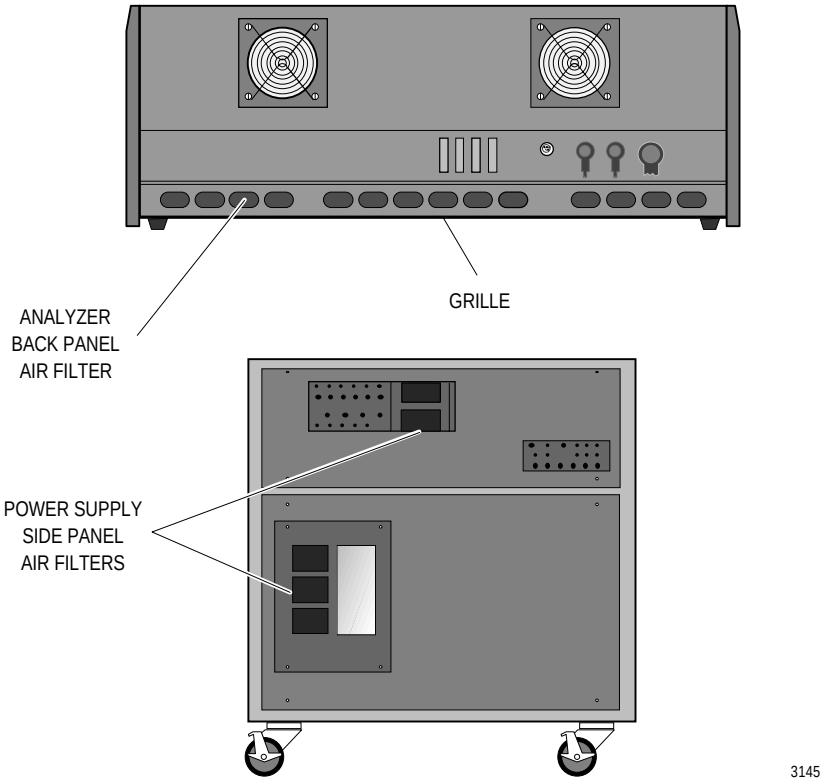

Figure 12 Location of Air Filters

Clean Vacuum Isolator Chamber (VIC)

WARNING

The VIC can contain residual biological materials and must be handled with care. Follow your laboratory's protocol for safety measures.

If you see evidence of protein buildup in the vacuum isolator chamber (VIC), bleach as follows:

1. Be sure the instrument power is on.
2. On the Diluter keypad:
   a. Press **PRIME APERT** to turn on the pneumatics.
   b. Press **F 0 5 ENTER** to access the individual solenoid activation function.
   c. Press **1 6 ENTER** to activate solenoid 16; this drains the VIC and the waste chamber.
   d. After the waste chamber drains, press **STOP** three times to deactivate the solenoid and exit the function.
3. Turn the power off.
4. Remove black O-ring from the VIC drain port.
5. Pull the VIC loose from the holding posts.
6. Disconnect one end of the U-shaped tubing connection on top of the VIC.
7. Use a hemostat to restrict liquid flow by pinching the tubing at the bottom of the VIC.
8. In a wash bottle, mix a solution of one part household bleach (5% solution of sodium hypochlorite) and one part distilled water.
9. Connect a piece of tubing to the spout of the wash bottle. Connect the other end to the VIC fitting where the U-shaped tubing was disconnected. See Figure 13.

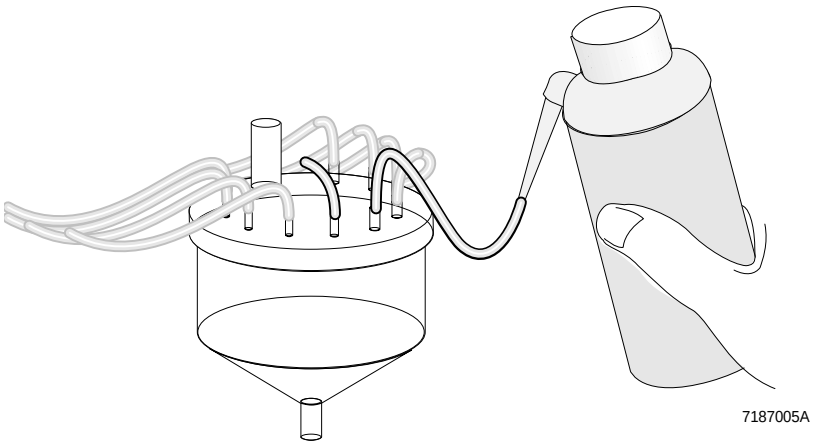

Figure 13 Clean VIC

CAUTION

Do not operate the instrument when the VIC is filled with bleach solution. To do so can cause the VIC to overflow.

10. Fill the VIC 1/2 to 3/4 full with the bleach solution.
11. Leave the bleach solution in the VIC for 15 minutes.
12. Reconnect the original tubing to the VIC.
13. Reinstall the VIC onto the holding posts and reinstall black O-ring on the bottom post.
14. Turn power on.
15. Unpinch the tubing at the bottom of the VIC.
16. On the Diluter keypad:
    a. Press **F 0 5 ENTER**.
    b. Press **1 6 ENTER** to activate solenoid 16; this drains the VIC into the waste chamber and then drains the waste chamber.
    c. After both chambers drain, press **STOP** three times to deactivate the solenoid and exit function F05.

17. Perform a shutdown cycle.

18. Perform a startup cycle.

Clean Waste Chamber

WARNING

The waste chamber can contain residual biological materials and must be handled with care. Follow your laboratory's protocol for safety measures.

CAUTION

Do not operate the instrument when the waste chamber is filled with bleach solution. To do so can cause the waste chamber to overflow.

If you see protein buildup in the waste chamber, bleach as follows:

1. Be sure the pneumatics are on.

2. On the Diluter keypad:

   a. Press **DRAIN**.

   b. Press **F 0 5 ENTER** to activate the individual solenoid function.

   c. Press **1 5 ENTER** to activate solenoid 15; this drains the waste chamber.

   d. After the waste chamber drains, press **STOP** three times to deactivate the solenoids and exit the function.

3. Power down.

4. Open the upper Diluter front door and remove the light bar.

5. Tilt the rocker bed back to reach the waste chamber.

6. Locate the fitting with the extension inside the waste chamber and disconnect the tubing from this fitting.

7. Disconnect the tubing from any other fitting for vent.

8. Restrict liquid flow by pinching the tubing at the bottom of the waste chamber.

9. In a wash bottle, mix a solution of one part household bleach (5% solution of sodium hypochlorite) and one part distilled water.

10. Connect a piece of tubing to the spout of the wash bottle. Connect the other end to the waste chamber fitting with the extension and fill the waste chamber with the bleach solution.

11. Leave the bleach solution in the waste chamber for approximately 15 minutes.

12. Unpinch the tubing at the bottom of the waste chamber.

13. Reconnect the original tubing to the waste chamber.

14. Power up.

15. On the Diluter keypad, use F05 to activate solenoid 15 to drain the waste chamber, then exit the function.

16. Replace the light bar and close the upper Diluter front door.

17. If protein deposits remain, repeat the procedure.

Clean Vacuum Trap Bottle

The vacuum trap bottle is located on the front of the Power Supply. Liquid in this bottle occurs when the waste chamber does not drain or when it overflows. If there is any liquid in this bottle:

1. Determine its source and correct the problem. If unable to determine the source, call Coulter Customer Operations.

2. Check that all pressure and vacuum gauges on the Power Supply indicate zero.

WARNING

The contents of the vacuum trap bottle may include residual biological material and must be handled with care. Avoid skin contact and clean up spills immediately. Dispose of the liquid in accordance with acceptable laboratory procedures.

3. Unscrew the vacuum trap bottle and dispose of the liquid.

4. Wash the bottle and the float with tap water, and dry with a lint-free cloth.

5. Screw the vacuum trap bottle into its holder on the front of the Power Supply.

Bleach RBC Internal Electrode

If you observe a red/brown buildup on the RBC internal electrodes, perform the following procedure.

1. Follow steps 1 through 16 of the Bleach Aperture procedure, except prepare 50 mL of the bleach solution.

2. Disconnect the three sweep-flow lines at the bottom of the RBC bath. Do not remove the white fittings.

3. Attach a piece of tubing approximately 10 in. long to each fitting. Place the ends of the tubing into a beaker of the bleach solution.

4. On the Diluter keypad:

   a. Press **PRIME APERT** to turn on the pneumatics.

   b. Press **F 0 5 ENTER**.

   c. Press **1 6 ENTER** to activate solenoid 16; the vacuum isolator drains. Press **ENTER** again to deactivate solenoid 16.

   d. Press **STOP**; the Diluter keypad display returns to SOLENOID XX.

   e. Press **1 1 ENTER** to activate solenoid 11 for approximately 15 s; this draws the bleach solution into the RBC aperture housing. Press **ENTER** to deactivate solenoid 11.

f. Activate solenoid 16 as needed to empty the vacuum isolator. Do not let the liquid in the vacuum isolator rise above 2/3 full. Press **ENTER** to deactivate solenoid 16.

g. Press **STOP** three times to exit function F05.

5. Leave the bleach solution in the baths and aperture housings for 15 minutes.

6. Press **PRIME APERT** to activate the pneumatics and drain and rinse the baths.

7. Press **DRAIN**.

8. Follow steps 19 through 25 of the Bleach Aperture procedure.

9. Transfer the ends of the tubing connected to the fittings on the RBC bath from the beaker of bleach solution to one containing cleaning agent.

10. On the Diluter keypad:

    a. Activate solenoid 11 to draw cleaning agent into the RBC aperture housing. Do not let the liquid level in the vacuum isolator rise above 2/3 full. Press **ENTER** to deactivate solenoid 11.

    b. Activate solenoid 16 to drain the vacuum isolator. Press **ENTER** to deactivate solenoid 16.

11. Repeat step 10 until the bleach is removed. Press **STOP** three times to exit function F05.

12. Disconnect the three lengths of tubing from the white fittings on the RBC bath. Reconnect the sweep-flow lines.

13. Press **DRAIN**.

14. On the Diluter keypad, press **F 1 2**; this activates the extended clear cycle to remove any remaining bleach from behind the apertures. Press **STOP** to exit this function.

15. Press **SHUT DOWN**.

16. Follow steps 28 through 32 of the Bleach Aperture procedure.

Drain Overflow Chamber

If the overflow chamber has liquid in it because the baths overflowed, drain as follows. To observe the overflow chamber, tilt the rocker bed backward.

1. Be sure the pneumatics are on.
2. On the Diluter keypad:
   a. Press **F 0 5 ENTER**.
   b. Press **0 9 ENTER**.
   c. After the overflow chamber drains, press **STOP** three times to deactivate the solenoids and exit the function.

Clean Drip Plate

The white drip plate is located in the Diluter beneath the BSV module; see Figure 14. If you see blood or reagent buildup on the drip plate, clean as follows.

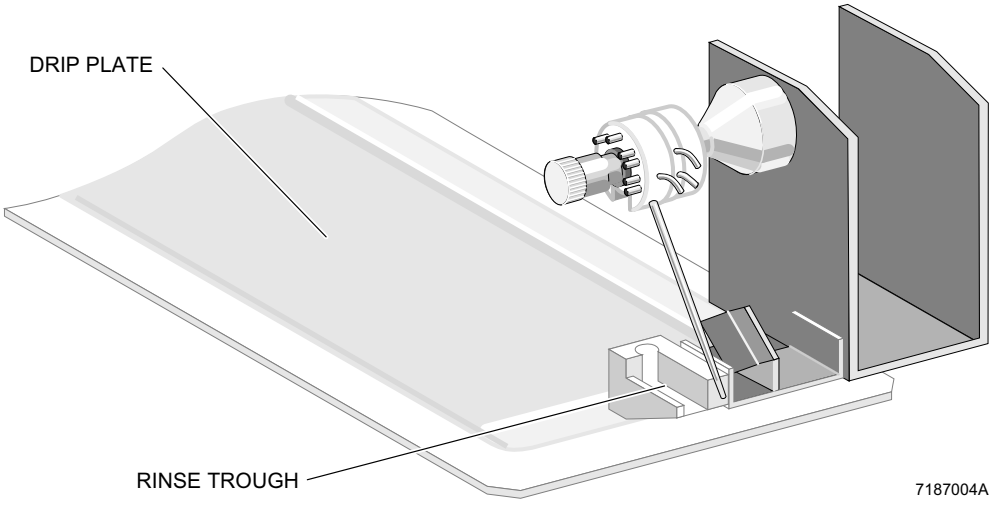

Figure 14 Drip Plate

WARNING

The drip plate may contain biohazardous material, and must be maintained with care. Avoid skin contact and dispose of cleaning materials properly.

1. In a wash bottle, mix a solution of one part household bleach (5% solution of sodium hypochlorite) and one part distilled water.
2. Open the lower Diluter door.
3. Use the wash bottle to fill the drip plate with the bleach solution. Be careful not to overflow the drip plate.
4. Leave the bleach solution in the drip plate for 15 minutes.
5. Use gauze held with a hemostat to clean the entire surface.
6. Use clean, dry gauze to soak up any excess bleach solution.
7. Use a wash bottle with distilled water to rinse the drip plate.
8. Use clean, dry gauze to soak up any excess water.
9. Close the Diluter door.

WARNING

Some replaceable items may have come in contact with residual biological material. Dispose of these items in accordance with acceptable laboratory procedures.

IMPORTANT

Tubing that is tagged by a red ring must be a specific length. Do not change the length of this tubing. If you detect a problem with a tagged piece of tubing, call Coulter Customer Operations.

4.1 REPLACE REAGENTS

When you replace a reagent container:

1. Unscrew cap on old container.
2. Lift and remove the cap carefully so that you do not contaminate the attached tubing. Do not touch the tubing.
3. Open the new container. Be careful not to contaminate it.
4. Insert the tube and the cap into the new container.
5. Tighten the cap.

When you replace reagents, record on the DMS and in your logbook the new container's lot number, expiration date, today's date, and your initials. The chart below shows how to prime the various reagents and components. Be sure the pneumatics are on before you do any of these.

To Prime Reagents:	Use Diluter Key/Function	At least this many times
Diluent	F16	1
CBC lyse and Hgb cuvette	F02	1
SCATTER PAK reagents	F17	1
All reagents except cleaning agent	**START UP**	1

To Prime Reagents:	Use Diluter Key/Function	At least this many times
To Prime Specific Components:		
RBC dispenser	**PRIME APERT**	2
WBC dispenser	**PRIME APERT**	2
Cleaning agent pump	F13	5
Sweep flow	F08	3
Backwash pump	F04	5
Needle rinse pump	**START UP**	1
Hgb pump	F02	1
Aspiration pumps	**START UP**	1
Sheath tank	Diluter reset	1

4.2 REPLACE WASTE CONTAINER

WARNING

The contents of the old waste container and its associated tubing may include residual biological material and must be handled with care. Avoid skin contact and clean up spills immediately. Dispose of the contents of the waste container in accordance with acceptable laboratory procedures.

1. Unscrew the pickup tube assembly from the old container.
2. Lift the pickup tube assembly straight out of the old container.
3. Place the pickup tube assembly straight into the new container and screw into position.
4. Label the new container as "Waste." Verify the old container is clearly labeled, then discard according to your laboratory standards for biohazardous material.

4.3 REPLACE FUSES

Fuses for the Power Pack Module and the Control Module are in the upper right side panel of the Power Supply. For fuse location and description, see Table 8, Open-Fuse Indications.

1. Before replacing any fuses, power down.

2. All the fuse caps are spring-loaded. To remove a fuse, push in and turn the cap 1/4-turn counterclockwise. The fuse cap will pop out of its holder when released.

3. Remove the open fuse and replace with a fuse of the same type and rating only. The amperage and voltage rating is written on the fuse. You can insert the fuse in either direction.

4. Return the fuse and its cap by inserting the fuse and turning the cap 1/4-turn clockwise while pushing in.

CAUTION

If a fuse fails shortly after replacement, power down, and call your Coulter Representative.

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5. Power up.

Table 8 Open-Fuse Indications

Location	Fuse Number	Fuse	Indication
Power Pack Module, Power Supply	F1	5 A (SB)	-9 Vdc lamp lights.
	F2	4 A	+20 Vdc lamp lights.
	F3	3 A	-20 Vdc lamp lights.
	F4	2 A	+24 Vdc lamp lights.
	F5	20 A With new scope module: 25 A (SB)	+9 Vdc and PNEUMATICS lamps light.
	F6, F10	3 A (two SBs)	All lamps light except +345 Vdc, PNEU TEMP, and ELEC TEMP.
	F7	6/10 A (SB)	No image on oscilloscope.
	F8	1/16 A	+250 Vdc lamp lights.

continued

Table 8 Open-Fuse Indications

Location	Fuse Number	Fuse	Indication
continued			
	F9	5 A (SB)	No CRT display; no DIFF parameters.
Control Module, Power Supply	F1, F2	1/2 A (two SBs)	System turns off completely.
	F3	3 A	System turns off completely.
	F4, F5, F6	1/16 A (three SBs)	+345 Vdc lamp lights.
	F7	1/16 A	No WBC aperture current.
	F8	1/16 A	No RBC aperture current.

4.4 REPLACE APERTURE BATHS

Refer to Figure 11 to replace an aperture bath.

1. Lift the Diluter upper center front door and slide it back into the cabinet.
2. Be sure the pneumatics are on, then press **DRAIN** until the bath is empty.
3. Power down.
4. Remove the light bar.
5. Open the clear plastic door to the bath compartment.
6. Label and disconnect the tubing attached to the bath.
7. Unhook the spring attached to each side of the bath.
8. Disconnect the electrode cable from the center front panel. The cable comes from the right on the RBC bath and from the left on the WBC bath.
9. Gently pull the bath off the large O-rings. If you have spare O-rings available, install new ones.
10. Moisten the large O-rings with distilled water, and place the new bath in position by gently rocking the bath onto the large O-rings until the bath snaps into place. The bath must be properly aligned with all three blocks to prevent leaking.

11. While holding the bath in place, hook the spring to each side of the bath.

12. Connect the electrode cable to the center front panel.

13. Connect the labeled tubing to the new bath.

14. Power up.

15. Drain and rinse the baths several times to check for leaks.

16. Be sure the apertures are well covered with diluent, then:

    a. On the Diluter keypad, press **F 0 5 ENTER**.

    b. Activate solenoid 10 (press **1 0 ENTER**) for the WBC bath or solenoid 11 (press **1 1 ENTER**) for the RBC bath and verify that no air is being pulled around the O-rings.

    c. Press **STOP** three times to deactivate the solenoid and exit the function.

17. Cycle the unit several times to prime.

18. Replace the light bar. Be careful not to pinch any tubing.

19. Close the Diluter center front doors.

20. Be sure that controls for the CBC parameters are within limits before running patient samples.

4.5 REPLACE O-RINGS

There are three O-rings on each aperture block (refer to Figure 11): a large one on the front, and a small one on the top and on the bottom. Replace as follows:

1. Perform steps 1 through 5 and 7 through 9 of the Aperture Baths replacement procedure.

IMPORTANT

Remove only one aperture block at a time to avoid mismatching the apertures. It is important that the aperture blocks be in the proper location.

CAUTION

Do not touch the center of the block where the aperture is.

2. To remove the aperture block, loosen the white fitting beneath the housing, and pull the block out. On the RBC side, disconnect the sweep flow tubing.

3. Remove and discard the defective O-ring.

4. Fit a new O-ring into the groove.

5. Align the aperture block so that the beveled edge is at the top left corner, and put it back into its housing.

6. Tighten the white fitting, fingertight only. On the RBC side, reconnect the sweep flow tubing.

7. Perform steps 10 through 12 and 14 through 18 of the Aperture Baths replacement procedure.

8. Verify that there are no air bubbles in the three vacuum lines from either bath to the vacuum isolator.

9. Close the Diluter center front doors.

10. Be sure that controls for the CBC parameters are within limits before running patient samples.

4.6 REPLACE CHECK VALVES

Check valves are shaped like arrows. Record the direction in which the old check valve is pointing. One at a time, remove the tubing connected to the old check valve and transfer it to the new check valve, so that the direction of the flow is correct.

4.7 REPLACE AIR FILTERS

Before replacing any of the air filters, power down. To replace an air filter, remove the old and insert the new one. Refer to Air Filters, Cleaning Procedures for replacement.

4.8 REPLACE CHOKES

Chokes are color-coded by size. The arrow on the choke indicates the direction of pressure flow. When replacing a choke, be sure to use the same size (color) and install in the same direction. If the choke is wet or plugged, it may be necessary to replace the fittings also.

4.9 ATTACH TUBING TO A FITTING

To place silicone or polyurethane tubing on a fitting, lubricate the tubing by dipping the end into 70% isopropyl alcohol (rubbing alcohol). Carefully push straight onto fitting and be sure it is securely in place.

4.10 REPLACE PIERCING NEEDLE

Decontaminate Needle

Before you replace the needle, decontaminate it.

IMPORTANT

This is NOT a routine procedure. Perform this procedure only when you are going to remove the piercing needle.

IMPORTANT

Use only a high quality, fragrance-free household bleach. Check the container's label to verify that it is a 5% solution of sodium hypochlorite.

1. Prepare a fresh solution of one part bleach and one part distilled water.

2. Drain and rinse the baths; this drains the rinse trough.

3. Fill the needle trough with the bleach solution.

CAUTION

Exceeding the recommended 10 minute time limit can damage the stainless steel components associated with the rinse trough and needle.

---

4. Wait 10 minutes.

5. Drain the trough. On the Diluter keypad:

   a. Press **F 0 5 ENTER**; the message *SOLENOID XX* appears on the Diluter keypad display.

   b. Press **1 2 ENTER**; the baths drain.

   c. Press **STOP**; the message *SOLENOID XX* appears on the keypad display.

   d. Press **1 6 ENTER**; the rinse trough drains.

6. After the rinse trough drains, press **STOP** three times; the message *READY* appears on the keypad display.

Replace Needle

WARNING

The piercing needle is sharp and may contain biohazardous material. Handle it carefully to avoid skin puncture and use appropriate precautions.

To replace the piercing needle, use Figure 15 as a guide and proceed as follows. Note that slight distortion of the needle shaft is not a problem as long as the needle does not touch the stripper plate during any part of the stroke.

1. At the Diluter keypad, press **F 1 0 ENTER**; the needle rises and the rocker bed locks in the backward position.

2. For access to the needle, open the lower Diluter compartment door.

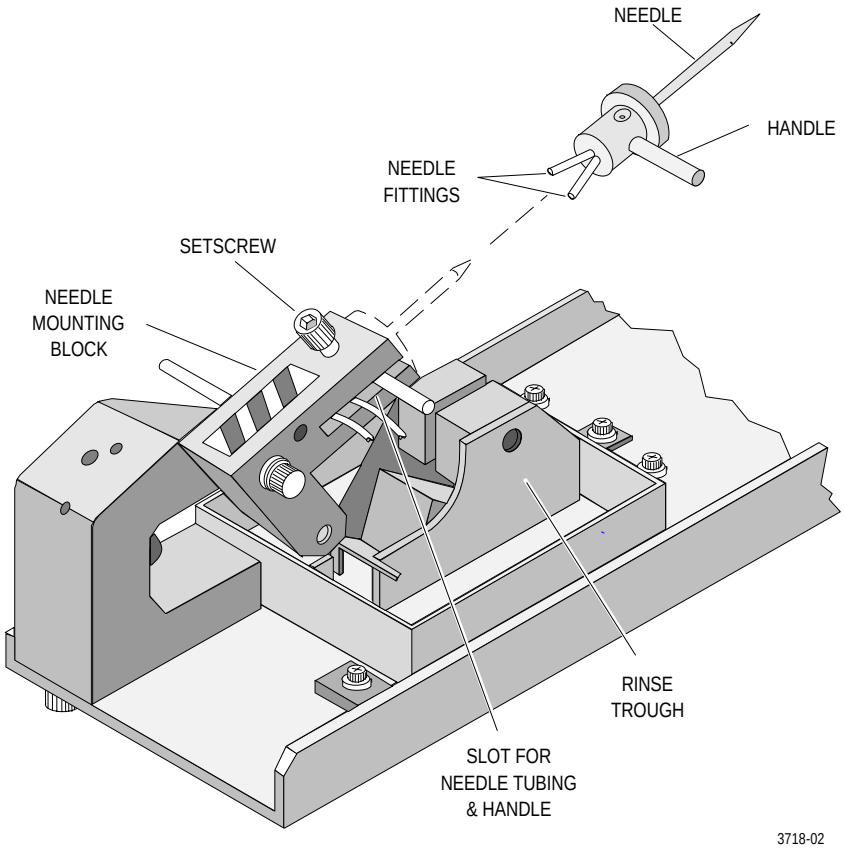

Figure 15 Replace Piercing Needle

3. Use the Allen wrench provided with your system to turn the setscrew on the needle mounting block counterclockwise to release the needle.

4. Grasp the needle handle and slide the needle out of the mounting block.

5. Because the fittings and tubing are fragile, carefully remove the tubing, one at a time, from the fitting of the old needle and place it on the corresponding fitting of the new needle.

6. Slide the new needle into the mounting block. Align the tubing and handle in the slot.

7. Turn the setscrew clockwise to tighten.

8. Close the compartment door.

9. Press **STOP** to exit F10.

10. After the needle replacement is complete, you have two options. For convenience, go to step 11; for economy of reagents, go to step 12.

11. For convenience, after the needle replacement is complete:

    a. Press **SHUT DOWN**.

    b. When the shutdown cycles are complete and the Analyzer goes blank, press **START UP**.

    c. At the end of the startup cycle, verify that the background is acceptable. If the background is not acceptable, perform a manual background test.

12. For economy of reagents, after the needle replacement is complete:

    a. At the DMS, go to Start Up.

    b. At the Analyzer CRT, access the BACKGROUND TEST routine. Press in sequence the key next to:

       MAIN (if in SYSTEM RUN)
       ANALYZER FUNCTIONS
       STARTUP TESTS
       BACKGROUND TEST

    c. Verify that the background counts are within the limits. It might take two or three cycles.

13. Before you run a control or patient sample, enable the blood detector and prime the system by pressing **PRIME APERT** on the Diluter and cycling in the mode to be used

    - a normal whole-blood sample for CBC or CBC+DIFF mode, or
    - a prepared Retic sample for RETIC mode.

14. If a problem still exists, call Coulter Customer Operations.

4.11 REPLACE CASSETTE SPRING CLIP

If the fingers of the spring clip become flat so that tubes are not held securely in the cassette, replace the clip.

1. Grasp the clip by one of the fingers in the middle of the cassette and pull it out.

2. Insert the tabs of the new clip into the slots in the ends of the cassette.

3. Insert a tube in each position to verify that all positions are secure.

4.12 REPLACE CASSETTE LABELS

Labels numbered up to 1,000 are available for cassette identification. Each cassette can be identified by two labels: an ID and a bar code. The ID label gives the four-digit cassette number, and is visible when the cassettes are stacked. The bar-code label, which includes both the bar code and a human-readable form, identifies both the four-digit cassette number and a two-digit position number from 01 to 12.

Replace worn or damaged labels as needed, and add them to new cassettes. When replacing a label, be sure to remove all of the old label. Place the labels on the cassettes carefully; align the bar-code label marker with the marker on the cassette. Be sure to match the identification numbers on the bar-code label and the cassette label.

4.13 CHANGE RINSE TROUGH PAD

WARNING

The rinse trough pad may contain biohazardous material. Avoid skin contact and dispose of the pad and cleaning materials properly.

Symptoms that the pad needs replacing include:

- Appearance of specimen on the front of the stripper plate that is not corrected by simply cleaning the rinse trough
- A wet needle
- Excessive foaming in the trough

As needed, change the rinse trough pad. Refer to Figure 11.

1. Press **PRIME APERT** to turn on the pneumatics.

2. On the Diluter keypad, press **F 9 5 ENTER** to free the solenoids. The piercing needle now moves freely.

3. For access to the needle area, open the lower compartment door on the Diluter.

4. Push the bottom of the needle block as needed to move the needle up and out of the rinse trough.

5. Raise the needle to just above the trough.

6. Use a hemostat to grasp the rinse trough pad holder from the right side.

7. Pull the holder up to a perpendicular position.

8. Raise the needle all the way up, disengage the pad from the trough, and remove it.

9. Dispose of the old pad and holder according to laboratory standards for biohazardous material.

10. Replace the pad and holder:

    a. Raise the needle all the way up.

    b. Grasp the pad and holder with a hemostat and position perpendicularly behind the needle.

    c. Lower the needle and slide the holder into the trough at the same time.

    d. Be sure to insert the tab on the rinse trough pad in the notch on the front of the rinse trough, and verify that the needle moves freely in and out of the rinse trough.

11. Close the Diluter door.

12. Press **STOP** twice to exit F95.

4.14 ADJUST HEMOGLOBIN LAMP VOLTAGE

1. Verify that there is diluent in the baths, not cleaning agent.

2. At the Analyzer CRT, access the HGB LAMP ADJUST routine; press in sequence the key next to:

   MAIN (if in SYSTEM RUN)
   ANALYZER FUNCTIONS
   HGB LAMP ADJUST

   Diluent is delivered to the Hgb cuvette and the system automatically adjusts the lamp voltage.

   If a Level Sense message occurs, press the key next to MAIN to continue.

   If a *LAMP OUT OF VOLTAGE RANGE* message appears, call Coulter Customer Operations.

3. Return to the SYSTEM RUN mode and cycle a sample of diluent in the secondary mode.

4. At the Analyzer CRT, access the HGB READINGS routine; press in sequence the key next to:

   MAIN
   ANALYZER FUNCTIONS
   HGB READINGS

5. Verify that both the HGB BLANK and HGB SAMPLE voltages are between 7.5 V and 9.5 V. Record the readings in your logbook.

4.15 ADJUST TUBE DETECTOR

In the Primary mode, if your system produces multiple aspiration alarms, you may need to adjust the tube detector. For correct piercing, the stripper plate must be directly centered on the tube stopper. See Figure 16.

1. Place a cassette of empty, stoppered tubes on the rocker bed.

2. Be sure the pneumatics are on, then on the Diluter keypad, press **F 9 6**, **ENTER** to access the TUBE ADVANCE test. The cassette advances one tube position at a time. When it reaches the piercing station, the lamp on the tube detector assembly lights when the sensor detects a tube, and the stripper plate moves up to the tube stopper.

3. When the stripper plate moves up to a tube stopper, press **STOP** on the Diluter keypad; the cassette halts, and the stripper plate releases.

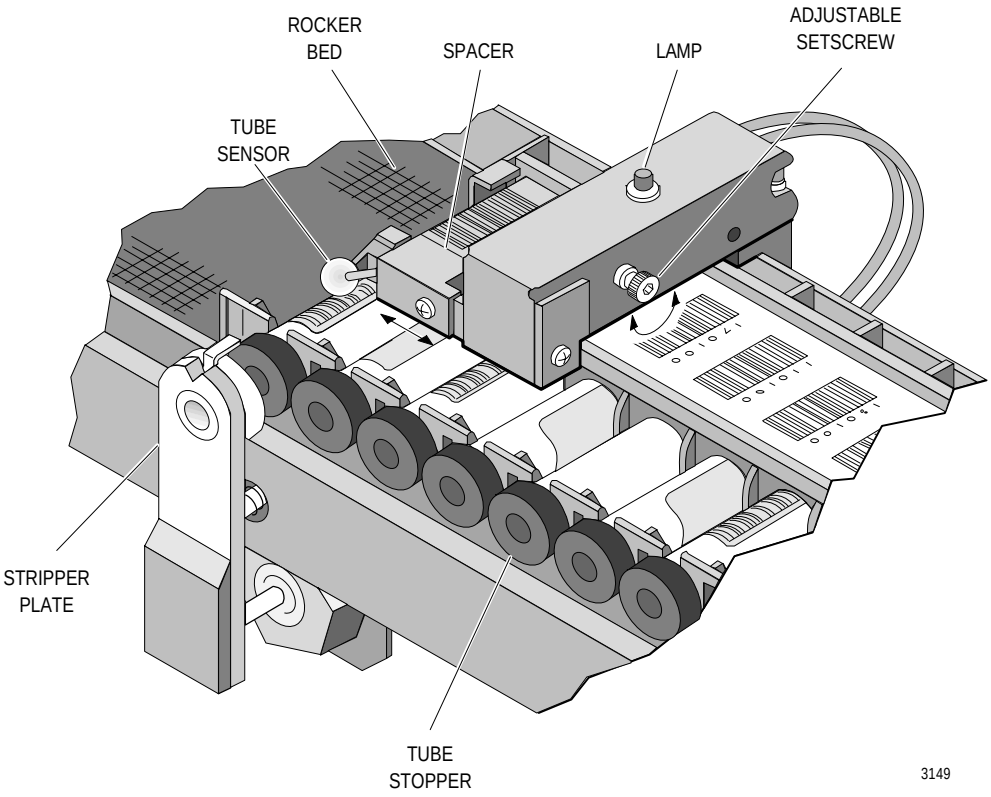

Figure 16 Tube Detector Adjustment

4. Use an Allen wrench in the recessed socket of the adjustable setscrew to move the spacer as needed.

   - Clockwise moves the sensor to the right
   - Counterclockwise moves the sensor to the left

5. Press **ENTER** on the Diluter keypad to resume the cassette advance.

6. Verify that the stripper plate centers directly on the tube stoppers.

7. When the adjustment is complete, press **STOP** twice to exit F96.

8. If the detector fails to hold the adjustment, call Coulter Customer Operations.

The troubleshooting procedures and error messages are:

Analyzer Reset Procedure
DMS Reset Procedure
Manual Ramp and Precision Tests
Retic Reproducibility Check
Prolonged Shutdown Procedure
Analyzer Clock Stopped
Analyzer ALERT messages
Diluter Diagnostic messages
DMS Error messages

WARNING

If a problem occurs while the system is cycling, press STOP on the Diluter keypad, and wait for the system to stop before you do anything to correct the problem.

5.1 ANALYZER RESET PROCEDURE

You can access the Analyzer reset function two ways.

- With the Analyzer door closed, press the reset button on the door; see Figure 17.
- With the Analyzer door open, press the RESET button on the MPU/87 card.

The reset function on the Analyzer MPU/87 card

- Unlocks the computer.
- Resets the electronic and pneumatic subsystems.
- Causes the baths to drain and rinse, and a backwash to occur.
- The Analyzer performs a memory test and senses the reagent and waste levels.

- If used when the unit is not cycling, data in the Analyzer memory from the last sample is erased.
- If used when the unit is cycling, any data in the Analyzer buffer that has not been transmitted to the DMS is erased.

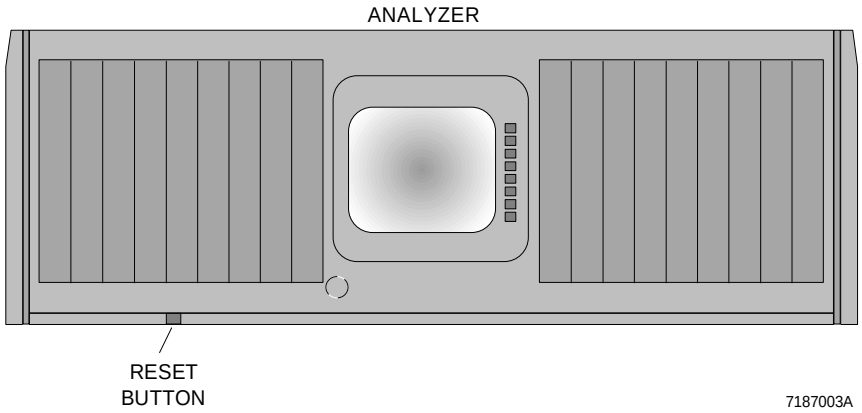

Figure 17 Reset Button Location

IMPORTANT

If either reset or a power failure occurs during the cycle, all data in the Analyzer buffer that has not been transmitted to the DMS is erased. Press PRIME APERT, then you must rerun the sample.

Use the RESET button to stop any cycle in progress (for example, startup, shutdown, or sample analysis), and when certain ALERT messages appear on the Analyzer CRT (see Table 9).

Perform the Analyzer reset procedure:

1. Press the RESET button. When the internal reset is complete a beeper sounds. The STATUS message on the Analyzer CRT changes from *INITIALIZATION* to *READY*.

    a. If reset clears the problem, proceed to step 2.

    b. If reset does not clear the problem, press the following buttons in the order given:

        1) Turn off the Graphic Printer.

2) Turn off the DMS.

3) Wait 15 seconds.

4) Turn on the DMS.

5) Turn on the Graphic Printer.

6) On the Diluter, POWER OFF.

7) On the Diluter, wait at least 30 seconds for the pneumatics to go down, then POWER ON.

If this clears the problem, proceed to step 2; if the problem still exists, call Coulter Customer Operations.

When you reset the DMS or turn it off then back on, these functions default to these conditions:

- Data Base storage: ON (DB↑)
- XB: ON (XB↑)
- AutoPrint: NONE (PR↓)
- AutoTransmit: OFF (HC↓)

Reset these options as needed according to your laboratory's protocol.

2. Disable the blood detector, then cycle diluent and monitor the ALERT messages.

   a. If no message appears, verify cassette position and resume operating.

   b. If the same message reappears, call Coulter Customer Operations.

5.2 DMS RESET PROCEDURE

DMS Not Working

If the DMS stops working, check the time field at the bottom of the screen. If the colon in the time field is flashing, the DMS is all right. If

the colon is not flashing, the DMS is locked up and you must reset it as follows:

1. Turn off the Graphic Printer.
2. Power off the DMS.
3. Wait 15 seconds.
4. Power on the DMS.
5. Turn on the Graphic Printer.

When you reset the DMS or turn it off then back on, these functions default to these conditions:

- Data Base storage: ON (DB↑)
- XB: ON (XB↑)
- AutoPrint: NONE (PR↓)
- AutoTransmit: OFF (HC↓)

Reset these options as needed according to your laboratory's protocol.

Printer Not Ready

If the DMS screen has a red box in the upper left corner with this message:

Printer Not Ready
Retry Abort Ignore

Check the Printer for: Printer off-line, paper jam, or out of paper. Correct the condition then be sure Retry is highlighted, and press **Enter**.

Lost Clusters

When you reboot the DMS, if this message occurs:

XX lost clusters found in XX chains

enter Yes when asked if you want to create a file.

Record the incident in your logbook. If this message occurs more than once a week, call Coulter Customer Operations.

5.3 RAMP AND PRECISION TESTS

1. Verify that clean diluent covers the apertures and that there is no bleach in the baths.

2. Set the DMS to the Startup screen.

3. At the Analyzer CRT, press in sequence the buttons next to:

   MAIN
   ANALYZER FUNCTIONS
   START UP TESTS
   RAMP TEST

   The system performs a ramp test and sends the results to the DMS.

4. Check the display on the DMS and verify that results are acceptable. If the results are not acceptable, rerun the test; if the problem remains, verify that there have been no changes in calibration. If there have not, call Coulter Customer Operations.

5. At the Analyzer CRT, still in the START UP TESTS mode, press the button next to PRECISION TEST. The system performs a precision test and sends the results to the DMS.

6. Check the display on the DMS and verify that results are acceptable. If the results are not acceptable, rerun the test; if the problem remains, verify that there have been no changes in calibration. If there have not, call Coulter Customer Operations.

7. At the Analyzer CRT, return to the SYSTEM RUN mode.

5.4 RETIC REPRODUCIBILITY CHECK

1. Be sure the Graphic printer is turned on.

2. At the Analyzer CRT, set MODE OF OPERATION to RETIC.

3. Press **Prime Aperture**.

4. At the DMS go to the Reproducibility mode. Select

   Special Functions
   Calibration
   Reproducibility

   Be sure there is no data from a previous reproducibility test on the screen. If there is, use F8 to delete all data.

5. Prepare a Retic whole-blood/stain preparation according to the instructions in the ReticPrep reagent kit. Incubate for at least 5 minutes.

   The Retic whole-blood/stain preparation can be used for up to 1 hour or 45 samples, whichever comes first. After that it must be replaced.

6. From the solution prepared in step 5, aspirate 2 µL directly into the bottom of a clean tube. Immediately add 2 mL of clearing solution. Wait 30 seconds, then aspirate.

7. The first sample is a Retic prime sample. Repeat steps 5 and 6 for 31 more Retic samples for the reproducibility test. Figure 18 illustrates a Retic Reproducibility display.

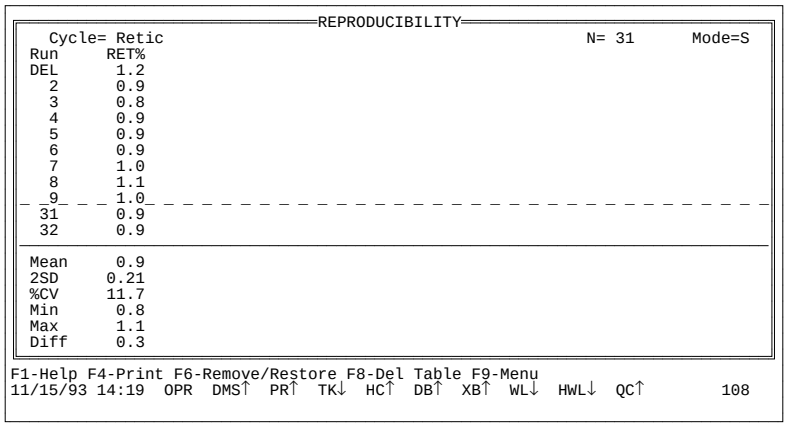

Figure 18 Retic Reproducibility

8. Delete the first sample, which is a prime:

   a. Move the cursor to the first line of the file.

   b. Press F6 **Remove/Restore** to delete the sample.

9. Check the statistics at the bottom of the screen. The results must not exceed these limits:

Mean Retic %	SD Limit	Max % CV
< 1.00%	.23	≤ 23%
1.00% to 4.00%	.23	≤ 17%
4.01% to 15.00%	.68	≤ 15%

5.5 PROLONGED SHUTDOWN PROCEDURE

If the COULTER STKS is going to be idle for more than 48 hours, perform the following Shutdown procedure.

1. Press **SHUT DOWN**. Let COULTER CLENZ cleaning agent remain in the instrument for at least 30 minutes.

2. Press **START UP** to put diluent in the lines.

3. According to your laboratory's protocol, either power down or leave power on.

4. Press **F 1 7 ENTER** to prime the diff reagents.

5. Put the DMS in the Startup mode and press **START UP**. Verify that results are within tolerance.

6. Perform and verify Quality Control checks per your laboratory's protocol.

7. Operate as usual.

Coulter recommends that you shut down the STKS for at least 30 minutes every 24 hours. If you leave your instrument powered on in Shutdown, and the pneumatics are off, an automatic purge occurs every 24 hours to prevent flow cell and sample line clogging.

5.6 ANALYZER CLOCK STOPPED

If the Analyzer clock stops, it sets the incomplete aspiration flag and sends to the DMS multiple samples with the same date and time. If the data base is turned on and the DMS finds a sample with the same date and time as the received sample, it stops the Analyzer and displays the message:

Sample <ID#1> *does not have a unique time* <Sample Run Time>

where:

- ID#1 is the ID read on the tube.
  Format is *XXXXXXXXXXXX*.

- Sample Run Time is the time attached to the sample run received.
  Format is *HH:MM:SS*.

The sample's results are displayed as dots (....), but they do not go into the data base.

If this condition occurs:

1. Turn off the Graphic Printer.

2. Turn off the DMS, wait 15 seconds, then turn back on.

   When you reset the DMS or turn it off then back on, these functions default to these conditions:

   - Data Base storage: ON (DB↑)

   - XB: ON (XB↑)

   - AutoPrint: NONE (PR↓)

   - AutoTransmit: OFF (HC↓)

   Reset these options as needed according to your laboratory's protocol.

3. Turn on the Graphic Printer.

4. Check the Analyzer CRT to see if the clock is incrementing. If not,

5. Perform the Analyzer reset procedure, then check the clock again. If it is still not working, call Coulter Customer Operations.

To run samples until Service arrives:

1. Turn the data base off. Select

   Sample Analysis
   Run Samples
   F5 Other

F4 DB Storage Off
F5 Auto Print ALL

2. Turn the Graphic Printer on.

Remember, these samples are not stored in the data base. Auto Print set to ALL causes all results to be printed.

5.7 ANALYZER ALERT MESSAGES

Table 9 describes the ALERT messages that appear on the Analyzer CRT. Note that when some of these alerts appear, a related message appears on the Diluter display. Some messages indicate a condition so severe that the system halts; for some, an audible alarm sounds. Any condition that causes the system to stop must be recorded on the ACTION LOG page of your logbook or on the DMS. When a SERVICE message occurs, record it and call Coulter Customer Operations.

If the system is set for a single aspiration per tube and an aspiration error occurs, the Analyzer displays *Aspiration 00* and the cycle aborts. The same tube is pierced a second time. If no error occurs on the second aspiration, the cycle finishes and the error counter resets to zero. If an error occurs on the second aspiration, its message appears on the Analyzer CRT, a continuous beep sounds, and the internal partial aspiration counter increments by one. There is no data available for that sample, and results appear as dots (.....). If there have been fewer than three errors, the cassette moves to the next position and the system pierces the next tube; if there have been three consecutive errors, the system stops.

Table 9 Analyzer ALERT Messages

Message	Cause	Alarm	System Halt	Operator Response
286 Board Communication Error	The DIFF PROC board is experiencing a communication problem.	No	Yes	Perform the Analyzer and the DMS reset procedures.
Aperture Voltage Lower Failed	Occurs when the reading during Monitor is 4.332 V.	No	No	Call Coulter Customer Operations.
Aperture Voltage Upper Failed	Occurs when the reading during Monitor exceeds 5.045 V.	No	No	Call Coulter Customer Operations.
				continued

Table 9 Analyzer ALERT Messages

Message	Cause	Alarm	System Halt	Operator Response
continued				
Aspiration 01 *Aspiration 02* *or* *Aspiration 03*	The blood detector is enabled (via Analyzer SYSTEM CONFIGURATION) and aspiration failed to meet certain internally-set criteria: 01: there is not significant difference between the diluent and the sample. or possible plugged or bent needle. 02: the front detector has detected air bubbles in the sample. 03: the difference between the reading of the front and rear detectors exceeded preset limits. or possible clog in BSV or Diff segmenting module. This message is echoed on the Diluter display until you press **ALARM RESET**: ASPIRATION 1-- or ASPIRATION -2- or ASPIRATION --3	Yes	No	Turn off the alarm by pressing **ALARM RESET**. The DMS displays dots (...) for all parameters; verify sample quality, then rerun the sample. The Graphic Printer prints dots for all parameters. 01: Check for plugged or bent needle. You can cycle in the Secondary mode.
Aspiration 04 *Aspiration 05* *or* *Aspiration 06*	There have been three consecutive occurrences of Aspiration 01, 02, and/or 03. The Diluter continues to indicate the last error: 1, 2, or 3.	Yes	Yes	The system defaults to the Secondary mode; either use the Secondary mode or: 1. Check the needle for plugs.
				continued

Table 9 Analyzer ALERT Messages

Message	Cause	Alarm	System Halt	Operator Response
continued				
Aspiration 04 *Aspiration 05* *or* *Aspiration 06*				2. Perform the Analyzer reset procedure. 3. Check for clots in all samples that have aspiration alarms. 4. Reposition the cassette as needed and recycle all clot-free samples that had aspiration alarms.
Autoclearing	The system detects a plug in the flow cell, and is clearing the flow cell with cleaning agent. The differential results are suppressed and replaced with the code :::: .	No	No	Monitor the Analyzer messages. If the flow cell is still plugged after 3 consecutive attempts to clear it, the system stops. See Flow Cell Clogged.
CBC Xmit Failure	Analyzer to DMS transmission failure	No	Yes	Perform the Analyzer and the DMS reset procedures.
Check DMS status	At the DMS, one of these situations has occurred: 1. Three consecutive NO READs of the tube label or 3 consecutive NO MATCH messages. 2. A total of 10 NO READ of tube, NO MATCH, and PART. ASP messages. 3. There is no communication between the Analyzer and the DMS.	Yes	Yes	1. and 2. At the DMS, clear the Error line by pressing **Alt** **Esc**. 3. Perform the Analyzer and DMS reset procedures.
				continued

Table 9 Analyzer ALERT Messages

Message	Cause	Alarm	System Halt	Operator Response
continued				
Check DMS status	4. The Auto-Stop feature is ON at the DMS and a control file error message has been generated.	Yes	Yes	4. At the DMS, clear the error line by pressing Alt Esc, or turn Auto-Stop OFF.
Check Level(s)	The level sensors are enabled (waste is always enabled; the reagents are enabled via Analyzer SYSTEM CONFIGURATION), and have sensed that one or more containers have enough for only approximately five more cycles. A related message on the Diluter indicates which container(s) as follows: LEVEL C--- for cleaner LEVEL --D- for diluent LEVEL --L-- for lytic reagent LEVEL ---P- for Scatter Pak LEVEL ----W for waste or any combination See also: Unacceptable Levels	Yes	No	1. Press **ALARM RESET** to turn off the alarm at each of the next five cycles, or 2. Press **STOP** to halt the system, change the relevant container(s), and prime the reagents.
CRC Error. Diff board	An error occurred during reset.	No	N/A	Perform reset procedure again; if message persists, call Coulter Customer Operations. You can disable the Diff and continue to run.
Diff Accumulation Not Finished	An error occurred during the accumulation of Diff data.	No	Yes	Perform the Analyzer and DMS reset procedures.
Diff Analog Pulses Test Failed	Indicates a possible problem with the ANALOG board.	No	No	Perform the Analyzer and DMS reset procedures.
				continued

Table 9 Analyzer ALERT Messages

Message	Cause	Alarm	System Halt	Operator Response
continued				
Diff Analysis Not Finished	An error occurred in the analysis of diff data.	No	Yes	Perform the Analyzer and DMS reset procedures.
Diff Math Incomplete	A system failure has occurred; the address of the problem is displayed.	No	Yes	Write down the address for Service, then reset the Analyzer board and the DMS.
Diff Pressure Lower Failed	Occurs when the reading during Monitor is 0 psi.	No	No	Call Coulter Customer Operations.
Diff Pressure Upper Failed	Occurs when reading during Monitor exceeds 6.55 psi.	No	No	Call Coulter Customer Operations.
Diff Processor Does Not Answer	The DIFF PROC board is defective or not properly installed.	No	No	1. Power down. 2. Push the board in and be sure it is seated securely. 3. Power up. 4. Perform the Analyzer reset procedure. If the message recurs, call Coulter Customer Operations. You can disable the Diff and Retics and continue to cycle.
Diff Processor Out Of Synch	The DIFF PROC board is defective or not properly installed.	No	No	1. Power down. 2. Push the board in and be sure it is seated securely. 3. Power up. 4. Perform the Analyzer reset procedure. If the message recurs, call Coulter Customer Operations. You can disable the Diff and continue to cycle.
				continued

Table 9 Analyzer ALERT Messages

Message	Cause	Alarm	System Halt	Operator Response
continued				
Diff Processor Out of Synch. Press Reset	The DIFF PROC board is defective or not properly installed.	No	No	1. Power down. 2. Push the board in and be sure it is seated securely. 3. Power up. 4. Perform the Analyzer reset procedure. If the message recurs, call Coulter Customer Operations. You can disable the Diff and continue to cycle.
Diff Xmit Failure	Analyzer to DMS transmission failure.	No	Yes	Perform the Analyzer and DMS reset procedures.
Diluter Error	A fault exists in the transport system. The system defaults to the Secondary mode, and one of these messages appears on the Diluter: *BED NOT FORWARD* *BED NOT BACKWARD* *BED NOT LEVEL* *FRONT DOOR OPEN* *LEFT LOAD FAIL* *RIGHT LOAD FAIL* *SERVICE XXX*	Yes	Yes	1. Record the message on the Diluter. 2. Either cycle in the Secondary mode, or perform the Analyzer reset procedure. a. If the fault recurs, call Coulter Customer Operations. b. If the fault does not recur, continue operating.
DMS Not Receiving	DMS is not receiving data from the Analyzer.	No	Yes	Perform the Analyzer and DMS reset procedures.
				continued

Table 9 Analyzer ALERT Messages

Message	Cause	Alarm	System Halt	Operator Response
continued				
Flow Cell Clogged	System has detected a clog in the flow cell and has tried to clear it three times without success.	Yes	Yes	1. Reset the Analyzer. 2. Use F44. 3. If message recurs, use F44 again. 4. If message recurs, use F45. 5. If message recurs, repeat F45. 6. If message recurs, use F45 a third time. 7. If message recurs, use F46 **once**. Let instrument sit idle for 30 minutes. Perform F44 before analyzing samples. 8. If message recurs, call Coulter Customer Operations.
Function not allowed	An illegal latex function has been entered.		No	Enter the correct function for the mode of operation that the system is set for.
I/O Cal Switches Set Wrong	The DVM/HGB switch on the I/O CAL card is set to DVM. The system does not operate	No	Yes	Set the switch to HGB.
Laser Voltage Lower Failed	The reading during Monitor was less than 4.63 V.	No	No	Call Coulter Customer Operations.
Laser Voltage Upper Failed	The reading during Monitor exceeded 5.93 V.	No	No	Call Coulter Customer Operations.
Monitor Task Did Not Finish	The Monitor process did not finish.	No	Yes	Perform the Analyzer and DMS reset procedures.
				continued

Table 9 Analyzer ALERT Messages

Message	Cause	Alarm	System Halt	Operator Response
continued				
Non Diluter Error	The system has detected an internal Diluter error. The Diluter displays *SERVICE XXX* message. The Diluter received no message from the Analyzer within 5 seconds of being ready to pierce in the Primary mode. The Diluter displays *ASPIR. TIMEOUT* message. A clog is detected in the flow cell after 3 attempts to unclog it. The Diluter displays *FLOW CELL CLOG* message. The R.F. Preamp voltage is low, or the 117 Vac fuse is blown. The Diluter displays *RF VOLTAGE LOW*. If this occurs during Start Up, operation continues; if it occurs during other cycles, the system halts. The sheath tank is not full when it should be. The Diluter displays *TANK NOT FILLED* message. The sheath tank is full when it should not be. The Diluter displays *TANK STILL FULL* message.	Yes	Yes	Perform the Analyzer reset procedure.
Operator Alert BB, BF, B0, FB, FF, F0	Slow speed has been detected during one or more segments of the bar-code reader's forward and back sweep.	No	No	Monitor the bar-code reader. If these messages occur repeatedly, a *SERVICE* message is generated that halts the system.
				continued

Table 9 Analyzer ALERT Messages

Message	Cause	Alarm	System Halt	Operator Response
continued				
Operator Alert 01	A problem is detected with the current cassette position.	Yes	Yes	Reposition cassette and press **START/CONT**.
Operator Alert 02	The bar-code reader has made two sweeps (one sweep equals a forward and a backward pass). On the first sweep, it did not read the tube label on either pass; on the second sweep, it read the label on only one pass.	No	No	Verify that the bar-code label is properly placed on the tube and that the tube detector is adjusted properly.
Operator Alert 05	An internal test that the Analyzer performs each cycle indicates an error in the calibration factors.	No	Yes	Perform the Analyzer reset procedure, then either: 1. In the Analyzer CRT CALIBRATION FACTORS mode, reenter all calibration factors as recorded in your logbook. 2. Recalibrate.
Operator Alert 06	The system has detected an internal calibration factor error.	No	Yes	Perform the Analyzer reset procedure, then either: 1. In the Analyzer CRT CALIBRATION FACTORS mode, reenter all calibration factors as recorded in your logbook. 2. Recalibrate.
Operator Alert 12	The bar-code reader reads either two cassette labels or two tube labels in a single scan.	No	No	Check the bar-code labels on the cassette and tube for position and clarity.
				continued

Table 9 Analyzer ALERT Messages

Message	Cause	Alarm	System Halt	Operator Response
continued				
PLT No Fit	A no-fit situation has occurred on the Plt data.	No	No	No response is necessary. The no-fit is indicated by the Plt histogram in the Run Samples mode on the DMS.
Power Failure	Power to the system has been interrupted. The Diluter displays *POWER FAIL*.	Yes	Yes	Perform the Analyzer reset procedure.
[Power Supply]: *+12V Supply Failed* *Spare Supply Failed* *+15VA Supply Failed* *+15VB Supply Failed* *−15VA Supply Failed* *−15VB Supply Failed* *−24VB Supply Failed* *+325 Supply Failed* *+5VA Supply Failed* *+5VB Supply Failed* *+5VC Supply Failed* *+5VD Supply Failed* *+5VE Supply Failed* *+5VF Supply Failed*	Each of these messages indicates a problem with the Power Supply.	No	Yes	Check the fuses and replace as needed. If the message recurs, call Coulter Customer Operations.
Primary Retics Not Allowed	An attempt has been made to run in the Primary mode when the Mode of Operation is set to Retic.	No	No	If it is a Retic sample, process it through the Secondary mode. If it is not a Retic sample, change the Mode of Operation.
Retics Accum Not finished	An error occurred during the accumulation of the Retic data.	No	Yes	Perform the Analyzer and DMS reset procedures.
Retics Analysis Not Finished	An error occurred during the retic analysis.	No	Yes	Perform the Analyzer and DMS reset procedures.
RF Voltage Lower Failed	The reading during Monitor was less than 5.9 V.	No	No	Call Coulter Customer Operations.
RF Voltage Upper Failed	The reading during Monitor exceeded 6.6 V.	No	No	Call Coulter Customer Operations.
				continued

Table 9 Analyzer ALERT Messages

Message	Cause	Alarm	System Halt	Operator Response
continued				
Run Aborted. DMS Not Ready	An Analyzer to DMS transmission failure occurred.	No	Yes	Perform the Analyzer and DMS reset procedures.
Secondary mode must have an ID	The Secondary mode activator has been pressed, but an identification number has not been entered on the Diluter keypad.	No	No	Enter an ID number on the Diluter keypad, then cycle the sample in the Secondary mode.
Service XX	A condition exists that requires a Coulter Representative. XX = a two-digit alpha or numeric code.	Yes	Yes	Record the two-digit code and call Coulter Customer Operations.
Sheath Pressure Lower Failed	The reading during Monitor was less than 6.25 psi.	No	No	Call Coulter Customer Operations.
Sheath Pressure Upper Failed	The reading during Monitor exceeded 6.55 psi.	No	No	Call Coulter Customer Operations.
3 Consecutive Vote Outs	There have been three consecutive voteouts of either WBC, RBC, Plt, or MCV.	No	Yes	Investigate the cause: 1. Check that the coaxial cables are connected properly. 2. Be sure there is diluent in the baths. 3. Check that the apertures are not blocked. 4. Perform the Analyzer reset procedure.
Unacceptable Level(s)	The Check Level(s) alert occurred five consecutive times. The Diluter continues to indicate the affected container(s).	Yes	Yes	1. Replace the reagent or waste container with a new one. 2. Perform the Analyzer reset procedure. 3. Prime the reagent.
				continued

Table 9 Analyzer ALERT Messages

Message	Cause	Alarm	System Halt	Operator Response
continued				
Unknown Diff Error Message	The DIFF PROC board is bad or not properly installed.	No	No	1. Power down. 2. Push the board in and be sure it is seated securely. 3. Power up. 4. Perform the Analyzer reset procedure. If the message recurs, call Coulter Customer Operations.

5.8 DILUTER DIAGNOSTIC MESSAGES

Table 10 describes the Diluter diagnostic messages.

Table 10 Diluter Diagnostic Messages

Message	What it Means	Action
ANALYZER ERROR	The Analyzer had a non-communication fatal error. One of the following messages occurs in the Analyzer ALERT field: Message — Description *Service 05* — Illegal Error code *Service OE* — Power Supply Fail 1 *Service OF* — Power Supply Fail 2 *Service 1F* — Stack Overflow *Service 21* — RAM Error *Service 22* — ROM Error *Service 23* — RAM/ROM Error *Service 24* — Red/White Counters Reset Error *Service 25* — Data Memory Reset Error *Service 29* — Interference RBC/WBC Data Memory *Service FF* — Bad Status *3 Consecutive Voteouts*	Record the error and call Coulter Customer Operations.
ASPIR. TIMEOUT	The Diluter received no message from the Analyzer within 5 seconds after the Diluter was ready to pierce.	Perform the Analyzer reset procedure.
ASPIRATION XXX	An aspiration error occurred. XXX can be 1--, -2- or --3.	• Press **ALARM RESET** to turn off the alarm. • You can cycle in the Secondary mode.
Auto Purge	24 hours have elapsed with the power on and the pneumatics off. The system turns on the pneumatics, purges the flow cell and associated sample lines with cleaning agent, then turns off the pneumatics.	This function occurs automatically. No operator action is necessary.
BED NOT ADVANCED	Bed did not advance to position the next tube for piercing, causing the same tube to be pierced again. The first time it occurs, the Analyzer displays *Operator Alert 01*. If this happens twice, the primary mode is disabled and the Analyzer displays *Diluter Error*.	• The first time it occurs, reposition cassette and press **START/CONT**. • The second time it occurs: 1. Record the Diluter message.
		continued

Table 10 Diluter Diagnostic Messages

Message	What it Means	Action
continued		
BED NOT ADVANCED		2. Either cycle in the Secondary mode, or perform the Analyzer reset procedure. -- If the fault does not recur, continue operating. -- If the fault recurs, call Coulter Customer Operations.
BED NOT BACKWARD	Bed not in backward position.	1. Record the Diluter message. 2. Either cycle in the Secondary mode, or perform the Analyzer reset procedure. -- If the fault does not recur, continue operating. -- If the fault recurs, call Coulter Customer Operations.
BED NOT FORWARD	Bed not in forward position.	1. Record the Diluter message. 2. Either cycle in the Secondary mode, or perform the Analyzer reset procedure. -- If the fault does not recur, continue operating. -- If the fault recurs, call Coulter Customer Operations.
BED NOT LEVEL	Bed not horizontal for loading or unloading cassettes, or bed overshot horizontal position.	1. Record the Diluter message. 2. Either cycle in the Secondary mode, or perform the Analyzer reset procedure. -- If the fault does not recur, continue operating. -- If the fault recurs, call Coulter Customer Operations.
		continued

Table 10 Diluter Diagnostic Messages

Message	What it Means	Action
continued		
DILUTER ERROR	A fatal Diluter software error occurred.	Perform the Analyzer reset procedure. If the error recurs, call Coulter Customer Operations.
FLOW CELL CLOG	The flow cell is still clogged after 3 attempts to unclog it. A *Non Diluter Error* message appears on the Analyzer.	Perform the Analyzer reset procedure.
FRONT DOOR OPEN	The front door sensor is not active.	Perform the Clear Flow Cell procedure. 1. Check the door. Be sure it is closed. 2. Record the Diluter message. 3. Either cycle in the Secondary mode, or perform the Analyzer reset procedure. -- If the fault does not recur, continue operating. -- If the fault recurs, call Coulter Customer Operations.
INVALID NUMBER	The code for a control number entered in the Secondary mode does not match the system's mode of operation.	When you enter a control number on the Diluter keypad, the first two digits identify the system's mode of operation. Be sure the mode setting and the identifying 2-digit code match: 00 = CBC/DIFF 03 = Retic
LABEL NOT READ	Cassette number and position of current sample was not read.	Clean or replace the cassette label, then rerun the sample.
		continued

Table 10 Diluter Diagnostic Messages

Message	What it Means	Action
continued		
LEFT LOAD FAIL	Sensor under left stack is still active when left lift is up.	1. Record the Diluter message. 2. Either cycle in the Secondary mode, or perform the Analyzer reset procedure. -- If the fault does not recur, continue operating. -- If the fault recurs, call Coulter Customer Operations.
LEVEL XXXXX	A level sense error occurred. X can be C (cleaner), D (diluent), L (3 diff lyse), P (pak) or W (waste). The Analyzer displays either *Check Level(s)* or *Unacceptable Levels*.	If the Analyzer message is *Check Level(s)*: 1. Press **ALARM RESET** to turn off the alarm. 2. Press **STOP** to halt the system, change the relevant container(s) and prime the reagent(s). If the Analyzer message is *Unacceptable Levels*: 1. Replace the reagent or waste container with a new one. 2. Perform the Analyzer reset procedure. 3. Prime the reagent.
POWER FAIL	A failure has been detected in the power circuit. The message on the Analyzer is *Power Failure.*	Perform the Analyzer reset procedure.
RF VOLTAGE LOW	The RF preamp voltage is low, or the 117 VAC fuse is blown.	Call Coulter Customer Operations.
		continued

Table 10 Diluter Diagnostic Messages

Message	What it Means	Action
continued		
RIGHT LOAD FAIL	Sensor under right stack is still active when right lift is down.	1. Record the Diluter message. 2. Either cycle in the Secondary mode, or perform the Analyzer reset procedure. -- If the fault does not recur, continue operating. -- If the fault recurs, call Coulter Customer Operations.
SERVICE 19A	New command (not CANCEL) was received after the WAIT command and before execution of the present command had begun.	For all *SERVICE XXX* messages that appear on the Diluter, check the Analyzer CRT. If the Analyzer message is: *Not Ready*, perform the Analyzer reset procedure. *Secondary*, you can use the Secondary mode for sample analysis.
SERVICE 19B	An illegal command was received from the Analyzer.	
SERVICE 19C	A CANCEL command was received during a time when it was invalid.	
SERVICE 19D	Two NAKs were received from the Analyzer after a long message transmission.	
SERVICE 19E	Neither ACK nor NAK echoed at the end of a long message transmission to the Analyzer.	
SERVICE 19F	Communication error.	
SERVICE 101	Manual mode switch is activated during 10 to 12 seconds of a cycle.	
SERVICE 103	Right lift not down.	
SERVICE 104	Left lift not up.	
SERVICE 105	Needle stuck.	
SERVICE 106	Needle stuck down.	
SERVICE 107	Needle stuck up.	
SERVICE 108	Right lift not up.	
SERVICE 111	Bar-code scanner slow.	
SERVICE 112	Stripper plate is not released.	
SERVICE 113	Stripper plate not pulled back.	
SERVICE 114	Scanner in wrong position.	
SERVICE 115	Too many labels read.	
		continued

Table 10 Diluter Diagnostic Messages

Message	What it Means	Action
continued		
SERVICE 116	Bar-code scanner slow.	
SERVICE 118	Bar-code scanner fast.	
SERVICE 120	Discrepancy detected in cassette label read during the forward and reverse strokes.	
SERVICE 121	Discrepancy detected in tube label read during forward and reverse strokes.	
SERVICE 122	Misplaced label. A tube label was read when a cassette label was expected, or a cassette label was read when a tube label was expected.	For all *SERVICE XXX* messages that appear on the Diluter, check the Analyzer CRT. If the Analyzer message is: *Not Ready*, perform the Analyzer reset procedure. *Secondary*, you can use the Secondary mode for sample analysis.
SERVICE 194	Unused interrupt received.	
SERVICE 196	Keyboard communication error.	
SERVICE 197	Bar-code reader communication error.	
SERVICE 198	CRC error.	
SERVICE 199	Analyzer communication error.	
SERVICE PROMS	Indicates the operator is using the diagnostic proms and trying to perform a function that can only be done with the regular Diluter proms.	Use correct proms.
SERVICE U48	Illegal variable read from RAM chip U48.	
STACK FULL	Either top safety device is active two consecutive times. Either a bay is overloaded, or the sensor is stuck.	If a bay is overloaded, adjust as needed. To unstick the sensor, pull down gently on the sensor plate at the top of the bay.
TANK NOT FILLED	After 20 seconds, the sheath tank level sensor indicates the tank is not full.	Perform Analyzer reset procedure. If the fault recurs, call Coulter Customer Operations.
TANK STILL FULL	After 20 seconds of trying to drain the sheath tank, the level sensor indicates the tank is still full.	Perform Analyzer reset procedure. If the fault recurs, call Coulter Customer Operations.
USE SERV. PROMS	Indicates the operator is trying to perform a function that can only be done with special diagnostic proms.	Use correct proms.

5.9 DMS ERROR MESSAGES

Table 11 describes the DMS error messages that require operator action. For other errors, call Coulter Customer Operations.

If an error message occurs on the error line, press Alt Esc to clear the message.

If an error occurs that causes the system to stop, a message is posted to the Error Log. Press Alt Esc to clear the error line at the bottom of the screen and allow the system to continue operating.

These are actual examples of messages. The numbers in parentheses at the end of a message indicate the Cassette/position number and ID #1. Collate failed messages include the identifiers from both the original sample and the current one.

Table 11 DMS Error Messages

Message	Means	Action
Batch aborted. Archive diskette is full	The archive operation has filled the disk. All batch operations in process are suspended.	Insert a new formatted disk and press F6 **Resume** to continue where the batch archive operation left off.
Batch unable to open Archive file - diskette is too full	When you press F8 **Execute** the system is unable to begin the archive operation. Archive operation is ignored, but other batch operations are performed.	Either: 1. Press F7 **Abort** to stop all batch operations. Insert a new disk and press F8 to restart all batch operations. Any samples that have already been printed or transmitted are printed and transmitted again. 2. Let the print and transmit operations go ahead and finish, then insert a new disk and execute only the archive operation.
CF invalid Diff or Retic	The Diff % or Retic results were invalid.	Rerun sample.
		continued

Table 11 DMS Error Messages

Message	Means	Action
continued		
Collate failed because Flowcell clogged (000102,) and (001605,).	Flow cell is clogged.	Perform the Clear Flow Cell procedure. Rerun sample.
Collate failed because internal criteria for collating failed (000703,) and (001101,)	Internal criteria failed.	Rerun sample.
Collate failed because RBC results edited (001109,) and (001103,)	Results cannot be edited before sample runs are collated.	Rerun sample.
Collate failed because RBC overrange (001210,) and (, 1235)	RBC overrange	Verify system performance and specimen integrity.
Collate failed because retic incomplete (low statistics) (000806,) and (,1224)	Too few events to complete algorithm.	Rerun sample.
Collate failed because sample too old (000406,) and (,1643)	Sample ID matches Worklist entry for collated run, but 24 hours elapsed since the first test was run.	Get a fresh sample. Reassign sample in Worklist. Rerun sample.
Collate failed because RBC, Diff or Retic incomplete (000108,) and (, 1123)	RBC, Diff, or Retic incomplete	Rerun sample.
Collate failed because RBC voteout (000112,) and (, 1125)	RBC voteout	Rerun sample.
CONTROL FILE 1, Normal. ONLY 5 RUNS LEFT	Space remains for results of n (up to five) control runs.	Print file when necessary.
CONTROL FILE 2, Normal, IS EXPIRED (05/01/93)	The date is the control's expiration date.	Verify lot# and expiration date. Correct error.
CONTROL FILE 4, Abnormal I, IS OUT OF RANGE	One or more of the last control run results is out of the expected value range.	Review results; follow your laboratory's protocol.
CONTROL FILE 11, Normal, IS FULL	The control file contains 100 runs and has space for no more results.	Print or archive file, if needed, then delete file. Rerun the control.
		continued

Table 11 DMS Error Messages

Message	Means	Action
continued		
CONTROL GRAPH FILE 1, RUN NUMBER 49: NO DATA AVAILABLE	Control file stores graphics for the last 50 runs.	No graphics data is available.
DBUSERID is already being used.	Internal DMS error.	Reset the DMS.
Digiboard error (XX) reset Analyzer and rerun sample.	Communication failure.	Reset Analyzer and rerun sample.
DISK DRIVE IS FULL, CANNOT SAVE CONTROL RUN	There is not enough space on the computer disk drive to store more control results.	Print or archive files if needed, then call Coulter Customer Operations.
Diskette error INVALID MEDIA	Disk not formatted correctly or disk is faulty.	Format disk or use a new formatted disk.
Diskette NOT READY	No disk in drive or disk not properly inserted.	Verify that: • There is a disk in the drive. • The disk is inserted properly.
Diskette SYSTEM ERROR	Disk is not formatted correctly or disk is faulty.	Format disk or use a new formatted disk.
Diskette WRITE PROTECTED	The write-protect tab is in the write-protect position.	Move the tab to the write position.
FILE FOR CONTROL LOT# 865420 NOT FOUND, OR SHIFT# DID NOT MATCH	File not found for control lot #, or shift # did not match.	Review file setup and correct error. Rerun control.
Inconsistent transmission received.	In Reproducibility, a sample has been analyzed in an aspiration mode or test mode that is different from data already in the Repro mode.	Delete the Repro table and rerun the sample.
Less than 1 Megabyte left on disk drive	Not enough space available on disk drive for DMS to operate properly.	Print or archive Data Base results if needed, then call Coulter Customer Operations.
		continued

Table 11 DMS Error Messages

Message	Means	Action
continued		
Lot and Shift number are in conflict Examples: *The same lot number with shift O exists in another file.* *Lot number and shift are duplicated in another file.* *The same lot number with shift 1, 2 or 3 exists in another file.*	Unable to set up control file. Occurs only during set up.	1. Review file set up. 2. Correct error. 3. Assign a non-conflicting lot# or shift.
MULTIPLE SAMPLES WITH SAME ID (1234) IN DATA BASE	AR3 cannot identify which sample to retrieve for ticket printing. It detects multiple samples with the same ID in the data base. The AR3 prints the ID # and the Multi ID message, but no results on the ticket.	To print sample results, • Turn bar-code reader off • Insert tickets with no bar-code labels • Sort sample in data base • Use F2 **Ticket** from Run Samples
NO MATCH: Sample run received does not match any worklist entry (000406, 1863)	The sample's positive identifier did not match any entry in the Worklist. Sample is saved to data base with NO MATCH message in Status field. *NO MATCH* is posted to the Error Log. Three consecutive No Match messages, or 10 accumulated *No Match, No Read,* and *Part. Asp* messages cause the system to stop.	Check Worklist for correct assignment of the Positive identifier. Rerun the sample. Press Alt Esc to restart the system.
		continued

Table 11 DMS Error Messages

Message	Means	Action
continued		
NO READ: Sample run received without proper identification (001212, 2541)	ID #1 is a Positive identifier and the tube label was not read. Sample is saved to the data base with *NO READ* message in Status field. *NO READ* is posted to the Error Log. The system discards parameter results and flags. Dots (....) appear in all parameter fields. Results cannot be edited. Three consecutive *No Read* messages, or 10 accumulated *No Match, No Read,* and *Part. Asp* messages cause the system to stop.	Verify that the tube label is correct and properly placed on the tube. Be sure label faces up. Rerun sample. Press Alt Esc to restart the system.
No space available to archive CONTROL file in Drive A	No room on the diskette to copy the file.	Use a new diskette with enough space available.
No space available to Archive LOG file in Drive A	No room on diskette to copy the file.	Use a new diskette with enough space available.
ONLY X DIGITS FOR I2OF5 CAN BE STORED IN DATA BASE	Number of digits in sample ID is different from samples already saved in data base.	Use Interleaved 2-of-5 labels with the same number of digits already stored in data base. To use I2-of-5 labels with a different number of digits, you must first delete the data base, then set the desired number of digits on the Analyzer CRT.
Operator acknowledged system stop errors	An error occurred that caused the system to stop. The operator pressed Alt Esc to acknowledge error and resume system operation.	Press Alt Esc to clear the error line.
		continued

Table 11 DMS Error Messages

Message	Means	Action
continued		
PART.ASP: aspiration error on sample (000406, 0016)	*System detected a partial aspiration of the sample.* *Three consecutive No Read* messages or 10 accumulated *No Match, No Read* and *Part. Asp* messages cause the system to stop. Dots (....) appear in all parameter fields.	Rerun the sample. Press Alt Esc to restart the system. Sample is saved to data base as a separate entry with *Part. Asp* in the status field. *Part. Asp* is posted to the Error log.
PREVIOUS DATE RCVD	In Workload, a date earlier than the last date was received.	Verify the date entry at the Analyzer CRT.
Sample XXX does not have a unique time (09:30:15)	A sample exists in the data base with the same date and time.	Perform the Analyzer Clock Stopped procedure.
Unable to Archive LOG file: ACTION.LOG	a. There is no diskette in drive A: b. The diskette in drive A: is not properly inserted. c. The diskette in drive A: is not formatted.	a. Insert diskette in drive A: b. Insert diskette properly. c. Insert a formatted diskette.
Unable to archive (CONTROL) file: File2.WKS	a. There is no diskette in drive A: b. The diskette in drive A: is not properly inserted. c. The diskette in drive A: is not formatted.	a. Insert diskette in drive A: b. Insert diskette properly. c. Insert a formatted diskette.
Warning: ID MISMATCH on non primary ID (000107, 1123)	The Positive ID is Cass/Pos only and both Cass/Pos and ID#1 are entered in the Worklist. The system reads a tube number that does not match the ID#1 entered in WL. or The Positive ID is ID#1 only and both Cass/Pos and ID#1 are entered in the Worklist. The system reads a Cass/Pos number that does not match the one in WL. Message could mean tube has been misplaced in cassette or ID was mistyped in the Worklist.	This is a warning. Verify specimen IDs and correct placement in cassette.
		continued

Table 11 DMS Error Messages

Message	Means	Action
continued		
	Results are saved in the data base with MISMATCH message in Status field. MISMATCH is posted to the Error Log. The sample report and the transmission to a host computer include both IDs: the preassigned one and the one read by the Analyzer.	
WORKLOAD - MAXIMUM COUNT REACHED - ACCUMULATION RESTARTED	Cycle count reached maximum of 1,166,400. The Workload data is printed automatically. The Workload counters automatically reset to restart accumulation.	No operator action required.
WORKLOAD - MAXIMUM DAYS REACHED - ACCUMULATION RESTARTED	The maximum days reached is ≥ 365. The Workload data is printed automatically. Workload counters automatically reset to restart accumulation.	No operator action required.

5.10 GRAPHIC/LASER PRINTER PRECAUTIONS

To ensure that your graphic or laser printer operates properly, you should:

1. Print out the Startup results each day.

2. Review the printout to ensure that it is legible, complete, and does not contain unexpected characters.

A complete printout has three parts:

- a header, followed by a line of dashes,
- the body, which contains the patient data, as configured on the Printer Definition screen, and parameter results, and
- a line of dashes at the end.

3. Refer to your printer's manual for further instructions if output is illegible, incomplete, or contains unexpected characters.

4. Be sure that you use the paper and ribbon or toner cartridge as recommended by your printer's manufacturer.

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REVISION STATUS

Issue A, 11/93
Software version 2A. Initial Issue

Issue B, 3/95
Change pages: cover, inside front cover, iii, iv, 25, 69, 70, 113, 114, 116, 117, trademarks and back cover.

Note: Changes that are part of the most recent revision are indicated in text by a black bar in the margin.

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■ **Special Procedures and Troubleshooting** PN 4237187 (Silver binding)	General Procedures Calibration Cleaning Procedures Replace/Adjust Procedures Troubleshooting
■ **Operator's Guide** PN 4237188 (Clear binding)	Controls and Indicators Startup Sample Analysis Data Analysis Shutdown Analyzer CRT Functions DMS Basics Sample Analysis Display Worklist Data Base Controls Apendices
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Miami, Florida 33196